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A WEST AFRICAN FETISH.

The Museum takes a conspicuous place in the Society's new home at Kensington Gore. Objects of geographical interest presented in the past can now be shown worthily, and the collection receives from time to time important accessions. We hope to publish occasional illustrations of our principal Museum objects, that they may be brought to the notice of other learned societies at home and abroad, and of Fellows who have not the opportunity of seeing them in the Society's house.

The subject of our first illustration is a Fetish which was taken on the Congo in 1865 when "the boats of Her Majesty's ship *Archer*, Captain Francis Marten, were engaged against the river pirates" ('History of the Royal Navy,' Clowes, vol. 7, p. 209). It was brought to England by Commander A. P. Eardley Willmot, and appears in the painting by Thomas Baines which hangs in the corridor on the first floor of the house.

The figure is of wood, with eyes of mica which glisten unpleasantly in the dusk. A number of heavy iron nails have been driven into its body.

In the painting the artist has represented a native chief driving a nail into the body of the Fetish as the boats of the *Archer* are opening fire; and it is sometimes said that this action denotes disappointment and anger with the god when things seem to be going badly. It does not appear, however, that this explanation is correct. We are indebted to Mr. T. A. Joyce of the British Museum for the following note:—

"The practice of knocking in nails has—as far as I can gather—two aspects. The simpler is when a worshipper, desirous of obtaining some favour, pays a fetish-man a fee and is allowed to drive a nail into the figure while uttering his petition (or the nail is driven in by the fetish-man on his behalf).

"The other is in connection with unauthorized 'black magic.' In this case the votary wishing to harm an enemy pays a heavy fee to the

fetishman to let him drive a nail (or to drive a nail on his behalf) into the figure. It is believed that the victim will fall sick and die in consequence. The result is that a man who feels ill and believes that his condition is due to the evil influence set in motion by some enemy, goes to the fetish man and makes inquiries, ultimately bribing him heavily to remove the nail and so ensure his recovery.

"The practice has nothing in common with the wax figure and pins of mediæval black art. In the latter case the wax figure represented the victim, and the maltreatment of the effigy was supposed by some occult sympathy to be reproduced in the person of the victim. The nail in the African figure is merely a reminder to the supernatural power which the image represents, to induce it to perform the wishes of the petitioner."

THE IMPORTANCE OF GEOGRAPHICAL RESEARCH.*

By Major H. G. LYONS, D.Sc., F.R.S.

THIS year, when the British Association is holding its meeting in times of the utmost gravity, the changed conditions which have been brought about by this war must occupy the attention of all the Sections to a greater or less extent, and our attention is being called to many fields in which our activities have been less marked or more restricted than they might have been, and where more serious study is to be desired. The same introspection may be usefully exercised in geography, for although that branch of knowledge has undoubtedly advanced in a remarkable degree during the last few decades, we have certainly allowed some parts of the subject to receive inadequate attention as compared with others, and the necessity for more serious study of many of its problems is abundantly evident.

Nor is the present occasion ill adapted to such an examination of our position, for when the British Association last met in this city, now twenty-eight years ago, the President of this Section, General Sir Charles Warren, urged in his address the importance of a full recognition of geography in education on the grounds that a thorough knowledge of it is required in every branch of life, and is nowhere more important than in diplomacy, politics, and administration.

Matters have certainly advanced greatly since that time, and a much fuller appreciation of geography now exists than that which formerly prevailed. At the time of the address to which I have referred the serious study of geography in this country was on the eve of important developments. The Council of the Royal Geographical Society had for some time been urging the importance of geography being studied at the universities

* Presidential Address to the Geographical Section, British Association, Manchester, September, 1915.

so that there should be an opportunity for advanced students to qualify themselves as scientific geographers by study and original research in the subject. The time had arrived for this ideal to become an accomplished fact, and in the following year, 1888, a Reader in Geography was appointed at Oxford University, and a Lectureship in the same subject was established at Cambridge. Since then the advance has been steady and continuous not only in the increased attention given to the subject, but also in the way in which it is treated. The earlier bald and unattractive statistical presentation of the subject has now been almost everywhere replaced by a more intelligent treatment of it, in which the influences of the various environments upon the life which inhabits a region are appreciated, and the responses to such influences are followed up. Instruction in the subject is given by those who have seriously studied it, who realize its importance, and who are in a position to train up new scientific workers in the field of geography. Though much remains to be done, there should be now a steady output of geographical investigators capable of providing an ever-increasing supply of carefully observed data, which they will have classified methodically and discussed critically, in order that these may be utilized to form sound generalizations as to their relationships and sequence in accordance with the method which is employed in all scientific work.

In order that we may see what advance has been made in the scientific study of geography in this country during the last quarter of a century, we must turn to the results that have been attained by the activity of geographical investigators who have devoted themselves to the serious study of various phenomena, and the detailed investigation of particular regions. If we do so I think that we must admit that the number of original investigators in scientific geography who are extending its scope in this way is not so large as it might be, nor are we yet utilizing sufficiently all the material which is available to us. Any one who will examine the geographical material which has been published in any period which he may select for review will find that purely descriptive treatment still far outweighs the analytical treatment which alone can lead to definite advances in scientific geography. If pleasing descriptions of this or that locality are sought for, they are for the most part to be found readily in the very large amount of such material that has been and is being published each year by residents, travellers, and explorers; but if information is desired in the prosecution of a piece of geographical research, we are checked by the lack of precise details. Few of this class of descriptions are sufficiently definite to enable the necessary comparisons to be made between one locality and others which are similarly situated; thoroughly quantitative treatment is for the most part lacking, and while a pleasing picture is drawn which is probably true in character, it is usually inadequately furnished with those definite facts which the geographer requires.

I propose, therefore, to examine a little more closely the question of geographical investigation and research in order to see where we stand and in what direction it behoves us to put forth our energies to the end that a branch of knowledge which is of such importance shall rest upon that basis of detailed study and investigation which alone can supply the starting-point for further advance. The intricate and complicated character of the subject, the extent of its purview, the numerous points at which it touches and imperceptibly passes into other well-defined branches of knowledge, render the study of geography very liable to degenerate into a purely descriptive treatment of the Earth's surface and all that is to be found thereon, rather than to follow the narrow path of scientific progress in which the careful collection of data furnishes the material for systematic discussion and study in order that trustworthy generalizations may be reached.

The opportunity to undertake long journeys through distant lands comes to few of us, but this is not the only direction in which research can be profitably undertaken, for there is no part of these islands where a geographer cannot find within his reach some geographical problem which is well worth working out, and which, if well and thoroughly done, will be a valuable contribution to his science. Even for such as cannot undertake such field work the library will provide a host of subjects which have not received nearly the amount of attention and of careful study that they deserve. The one thing essential is that the study should be as thorough as possible, so that all the contributory lines of evidence shall be brought together and compared, and so that the result may prove to be a real addition to geographical science on which other workers may in their turn build.

For those who desire to undertake such investigations there is at any rate no lack of geographical material, for travellers, explorers, and others engaged in various occupations in every part of the world are continually recording their experiences and describing their surroundings in books and pamphlets; they recount their experiences to the Geographical Societies, who apparently have no difficulty in obtaining communications of wide interest for their meetings. Most portions of the British Empire as well as regions belonging to other nations are in these days more or less fully examined, surveyed, and investigated with a view to their development, and those who undertake such work have ample opportunities for the most part for preparing descriptions of the lands in which they have sojourned and with which they are well acquainted. But although the material is so ample the quality of it is not generally such as makes it suitable for an adequate study of the phenomena or the region to which it relates. The ease with which a tract of country or a route can be described by the traveller, and the attractiveness of such a description of a little-known region, results in the provision of a vast quantity of geographical information, the greater part of which has probably been

collected by those who have no adequate training in the subject. In such cases it is not uncommon for the writer to disclaim any geological or botanical knowledge, for instance, but the great majority of those to whom the opportunity is given to travel and see new lands and peoples are fully convinced of their competence to describe accurately and sufficiently the geography of the regions which they traverse. But any one who has had occasion to make use of such material in a serious investigation is only too well aware how little precise and definite information he will be able to extract from the greater part of this wealth of material, and in most cases this is due to the traveller's lack of geographical knowledge. He probably does not know the phenomena which should be observed in the type of region which he is traversing, nor can he read the geographical evidence which lies patent to a trained observer at every point of the journey; much, therefore, of what he records may be of interest, but probably lacks data which are essential to the geographer if he is to understand the geographical character of the region, and utilize it properly.

Thus it happens that although the amount of geographical material which is being garnered may be large, the proportion of it which is available for use in a scientific investigation of an area is smaller than is probably realized by those who have not made the experiment. And yet it is only by this scientific investigation of selected localities or of a single phenomenon and by working them out as thoroughly as possible that any real advance in geographical science can be made. The accounts of such pieces of work will not appeal to those who desire picturesque descriptions of little-known lands, but they will be welcomed by geographers who can appreciate the value of such studies. There should now be an ever-increasing number of such geographers, trained to proceed in their investigations by the true scientific method, and there should be a very considerable amount of sound work in various branches of the subject which aims at thoroughly investigating some phenomenon, or group of phenomena, so as to present a grouping of data, carefully verified and critically discussed, in order to arrive at conclusions which may form a useful addition, however small, to the sum of our geographical knowledge.

So far as I am able to judge, the output of serious work of this character is not nearly as large as it should be, and I would indicate some fields in which there is a lack of individual work of this character. Until more of it is undertaken we shall lack in this country the material from which the foundations of scientific geography can be built up, and while our own islands and the various parts of the British Empire furnish unrivalled opportunities for such work, there are still far too many subjects where the most thorough investigations have been made in other countries.

Mathematical Geography presents a field for research which had comparatively little attention paid to it in this country. In many respects

this part of the subject is peculiarly suitable for such treatment, since it admits of the employment of precise methods to an extent which is not always practicable in cases where so many of the factors can only be approximately defined. The determination of positions on the earth's surface is carried to great refinement in the national surveys of most civilized countries in order to furnish the necessary controls for the preparation of large-scale maps, but when we pass to the location of travellers' routes, where considerable allowance has to be made for the conditions under which the observations have to be taken, we find that very inadequate attention is usually paid to the discussion of the results. Usually a mean value for each latitude, longitude or azimuth is obtained by the computer, and he remains satisfied with this, so that when the route of another traveller follows the same line or crosses it at one or more points, it is almost impossible for the cartographer to say which of the two determinations of any position is entitled to the greater confidence. In this class of work, whether the results are obtained from absolute observations at certain points or from the direction of march, and the distance traversed, it is quite practicable to determine the range of uncertainty within which the positions of different points are laid down, and it is eminently desirable that this should always be done in order that the adjustment of various routes which may intersect in partially-known regions may be adjusted in accordance with definite mathematical processes. Some important expeditions on which infinite labour and considerable sums have been expended have presented their results, in so far as they relate to the routes which have been followed and the position of points which have been determined, in such a way that it is impossible to say within what precision such positions have been determined, and consequently any combination of these results with those of later expeditions has to be carried out empirically, since adequate data are no longer available for the employment of better and more scientific methods.

This crude and unsatisfactory way of treating observations, which in many cases have been obtained under conditions of the greatest difficulty and even hardship, is largely due to the lack of interest which geographers have shown in this part of their subject. Methods of observation and methods of computation are rarely discussed before any of our Geographical Societies or in any of our publications, and it is only by such discussions that the importance of properly working out the available material at a time when the observer can be consulted on points which are doubtful, or where further explanation is desirable, becomes generally appreciated.

No set of physical or astronomical observations is ever discussed or even presented without the degree of precision or reliability being definitely stated; yet in geography this sound rule is too often neglected.

There are several regions where travellers' routes intersect which should provide ample material for the careful reduction and adjustment

of the results. I fear, however, that there would be great difficulty in obtaining the original observations which are indispensable in such an investigation, and in the interest of research it is highly desirable that the original documents of all work of importance should be preserved and the place where they may be consulted recorded in the published account.

There is room in the geographical investigation of sea and land, even within the limits of the British Empire, for the employment of methods of observation and computation of the highest precision as well as of the simpler and more approximate kinds, but every one who presents the results of his work should deem it his first duty to state explicitly the methods which he employed, and the accuracy to which he attained, in such a form that all who make use of them can judge for themselves of the degree of their reliability.

In such work, while the instruments used are of great importance, too often the briefest description, such as "a 4-inch theodolite," is deemed sufficient. If the observer wishes his work to be treated seriously as a definite contribution to science we require to know more than this, and a clear account of the essentials of the instrument, a statement of its errors, and of the methods of observation adopted are the least that will suffice. The account of any expedition should treat so fully of the instruments, observations, and computations utilized to determine the positions of places visited that any one can re-examine the evidence and form his opinion on the value of the results obtained. A mere tabular statement of accepted values, which frequently is all that is provided, is of small value from a scientific point of view. Probably one reason for this state of things is that too little attention is being paid by geographers to their instruments. Theodolites, levels, compasses, clinometers, tacheometers, plane-tables, pantographs, co-ordinatographs, planimeters, and the many other instruments which are used by the surveyor, the cartographer, the computer, have in no case arrived at a final state of perfection, but it is seldom that we find a critical description of an instrument in our journals. Descriptions there are from time to time, but these are for the most part weak and insufficient. Not only is a technical description required, which treats fully of both the optical and mechanical details, but we need an extended series of observations with the instrument which have been made under the ordinary conditions of practical work, and these must be mathematically analyzed, and the degree of the reliability of the results clearly demonstrated. The description should be equally thorough and complete, including scale drawings showing the construction of the instrument as well as photographs of it. Nothing less than this is of any use to the scientific cartographer.

While I am on the subject of instruments I would draw attention to the importance of the whole history of the development of surveying instruments. In the latter part of the eighteenth century Great Britain provided the best class of surveying instruments to all countries of

Europe, at a time when high-class geodetic work was being commenced in several countries; and about this time von Reichenbach spent a part of his time in this country working in the workshops of Dollond and learning this particular class of work. Upon his return to Bavaria he set up at Munich that establishment which soon provided instruments of the highest class for many of the cadastral surveys which were being undertaken in Central Europe. At Munich there is now a fine typical collection of such instruments, but in this country the early advances of British instrument-makers of surveying instruments are far from being adequately represented in our National Museum in a manner commensurate with their importance. The keen and enlightened zeal of geographers who are interested in this branch of the subject would doubtless quickly bring to light much still remaining that is of great interest, but which is yet unrecognized, while a closer attention to instrumental equipment would lead to improvements and advances in the types that are now employed. There is no modern work in this country on the development of such instruments, and references to their history are conspicuously rare in our journals, so that there is here an opportunity for those whose duties prevent them from undertaking travel or exploration of a more ambitious kind. In the same way, those whose opportunities of field work are few can find a promising field of study in the early methods and practice of surveying which have been discussed by many authors from classical times onwards, and for which a considerable amount of material exists.

In Geodesy and Surveying of high precision there is ample scope for all who are attracted by the mathematical aspect of the subject; the critical discussion of the instruments and methods employed and results obtained, both in this country and in other lands, provides opportunity for much work of real value, while its bearing upon geology, seismology, etc., has not yet been adequately treated here. The detailed history of this part of our subject is to be found in papers which have been published in the technical and scientific journals of other countries for the most part; here too little attention has been given to the subject, in spite of the large amount of geodetic work which has been executed in the British Empire, and which remains to be done in our Colonies and overseas Dominions.

The final expression of the surveyor's detailed measurements is found in the map, and the adequate representation of any land surface on a map-sheet is both a science and an art. Here we require additional work on all sides, for there is hardly any branch of geography which offers so remunerative a field for activity as cartography. We need the co-operation of trained geographers to study requirements, and to make acquaintance with the limits of technical methods of reproduction, so that they may be in a position to deal with many questions which arise in the preparation of a map regarding the most suitable mode of presentation of data, a

matter which is purely geographical, but which at the present time is too often left to the skilled draughtsman. Neither the compilation nor the reduction of maps are merely mechanical processes. The first requires great skill and care as well as technical knowledge and a sound method of treatment if the various pieces of work, which are brought together to make up the map of any considerable area, are to be utilized according to their true worth. This demands a competent knowledge of the work which has been previously done on the region, a first-hand acquaintance with the data collected by the earlier workers, and the critical examination of them in order that due weight may be given to the better material in the final result. This is not a task to be handed over to the draughtsman, who will mechanically incorporate the material as though it were all of equal accuracy, or will adjust discrepancies arbitrarily and not on any definite plan. Such preliminary preparation of cartographical material is a scientific operation which should be carried out by scientific methods and should be completed before the work reaches the draughtsman, who will then have but to introduce detail into a network of controls which has been prepared for him and of which the accuracy at all points has been definitely ascertained. Similarly in the second case the elimination of detail which must of necessity be omitted is an operation needing the greatest skill, a full understanding of the material available, and an adequate appreciation of the result which is being aimed at, such as is only to be found in a competent geographer who has made himself intimately acquainted with all the material which is available and has his critical faculty fully developed.

The use of maps has steadily increased of recent years, but we should look forward to an even more widely extended use of them in the future; and this will be greatly facilitated if there are geographers who have made themselves masters of the technique of map reproduction and, as scientific geographers, are prepared to select such data as are needed for any particular class of map on a well-considered method, and not by the haphazard procedure to which the want of a scientific study of cartographic methods must inevitably lead. The paucity of papers dealing with practical cartography and the compilation of maps is clear proof that this branch of the subject awaits far more serious attention than it now receives.

All these problems are well within the reach of the geographer to whom the opportunity of travel in other regions does not come, and in them he will find ready to his hand a field of research which is well worth working and which will amply repay any labour that is spent upon it. The same precise methods of investigation which are employed in the discussion of observations should be applied to all cartographic material in order to ascertain the exact standard of its reliability, in which is included not only the correctness of distance and direction, but also the accuracy of the information which has been incorporated in it; and these

may be brought to bear also on those early maps of which so many are preserved in our libraries in this country. In this field of study several investigators have already achieved results of great interest and value, but I think that they will be ready to admit that there is here a wide and profitable field of activity for many more workers who will study closely these early maps and, not being contented with verbal descriptions, will use quantitative methods wherever these are possible.

In the study of map projections some activity has been visible in recent years, and we may hope that those who have worked in this branch of the subject will see that British Geography is provided with a comprehensive manual of this subject which will be worthy of the vast importance of cartography to the Empire. The selection of suitable projections is receiving much more attention than was formerly accorded to it, but the number of communications on this subject which reach geographical journals are few and far between. The subject is not one which can appeal strongly to the amateur geographer, but its importance renders it imperative that the scientific geographer who realizes its intimate bearing upon all his work should so arrange that the matter does not fall into the background on this account.

A closer relation and a more active co-operation between those who are prepared to work seriously at cartography and its various problems may reasonably be expected to raise the standard of that class of map which is used to illustrate books of travel, or works descriptive of a region. At the present time the inadequate character of many of the maps and plans which are reproduced in such publications shows clearly that the public demand for maps which have been compiled with a view to illustrating the volume in question is still very ineffective.

The whole subject of cartography, with its component parts of map projection, compilation, reproduction, cartometry and the history of its development, is so important, not only to the individual geographer but also to the advancement of scientific geography, that we should aim at fostering it and encouraging the study of it in every way, and it will be the zeal of individuals rather than the benevolent aid of institutions which will achieve this.

But it may be suggested that the lack of activity in Mathematical Geography is due to the somewhat specialized nature of the subject, and to the fact that the number of those who have received an adequate mathematical training and are prepared to devote themselves to geography is few. When we turn to Physical Geography in its treatment of the land we do find a field which has been more actively worked, for this is just the one to which the traveller's and explorer's observations should contribute most largely, and where therefore their material should be utilized with the best results. Even here there is room for much more work of the detailed and critical type, which is not merely general and descriptive, but starts from the careful collection of data, proceeds

to the critical discussion of them, and continues by a comparison of the results with those obtained in similar observations in other regions.

To take a single branch of Physical Geography, the study of Rivers, the amount of accurate material which has been adequately discussed is small. In our own country the rainfall of various river basins is well known through the efforts of a Meteorological Association, but the proportion of it which is removed by evaporation, and of that which passes into the soil, has only been very partially studied. Passing to the run-off, which is more easy to determine satisfactorily, the carefully measured discharges of streams and rivers are not nearly so numerous as they should be if the hydrography of the rivers is to be adequately discussed; for although the more important rivers have been gauged by the authorities responsible for them in many cases, the results have usually been filed, and the information which has been published is usually a final value but without either the original data from which it has been deduced, or a full account given of the methods of measurement which have been employed. For the requirements of the authority concerned such a record is no doubt adequate, but the geographer requires the more detailed information if he is to co-ordinate satisfactorily the volume discharged with local rainfall, with changes in the rates of erosion or deposition, and the many other phenomena which make up the life-history of a river. Here too it is usually only the main stream which has been investigated; the tributaries still await a similar and even fuller study. A valuable contribution to work of this kind exists in the hydrographical study of the Medway and of the Exe which has been undertaken by a Committee of the Royal Geographical Society during recent years, and this may serve as a guide to other workers; but, however welcome such a piece of work may be, I should much prefer to see the hydrography of a tributary of a river system worked out by a geographer as a piece of individual work, just as the geology or the botany or the zoology of a single restricted area is investigated by those whose interests are centred in these subjects.

In the same way we still know too little of the amounts of the dissolved and suspended matter which is carried down by our streams at various seasons of the year and in the different parts of their course. This class of investigation does not need very elaborate equipment, and may provide the opportunity for much useful study, which may be extended as information is increasingly acquired. In this way when numerous individual workers have studied the conditions prevailing in their own areas, and traced them through their seasonal and yearly variations, we shall possess a mass of valuable data with which we may undertake a revision of the results which have been arrived at in past years by various workers from such data as were then at their disposal.

In this one branch of the subject there is ample scope for workers of all interests in the measurement of discharges, in the determination of level, and of the movement of flood waves, in determining the amount of matter

transported both in suspension and in solution, in tracing out the changes of the river channel, in following out the variation of the water-table which feeds the stream, in ascertaining the loss of water by seepage in various parts of its course, and generally in studying the hundred other phenomena which are well worth investigating, and which give ample scope for workers of all kinds and of all opportunities. There is work not only in the field, but also in the laboratory and in the library which needs doing, for the full account of even a single stream can only be prepared when data of all classes have been collected and discussed.

On the Scottish lakes much valuable scientific work has been done, and also on some of the English lakes, so that excellent examples of how such work should be done are available as a guide to any one who will devote his spare time for a year or two in making a thorough acquaintance with the characteristics and phenomena of any lake to which he has access.

Coast-lines provide another class of geographical control which repays detailed study, and presents numberless opportunities for systematic investigation and material for many profitable studies in geography. The shores of these islands include almost every variety of type, and furnish exceptional opportunities for research of a profitable character, especially as lying on the border-line between the domain of the oceanographer on the one hand and the physiographer on the other. The precise methods of representation which are possible on the land have to give way to a more generalized treatment over the sea, and the shore line is liable to be handed over to the latter sphere, so that there is much interesting and useful work open to any one who will make an accurate and detailed study of a selected piece of coast-line, co-ordinating it with the phenomena of the land and sea respectively.

The teaching of Prof. Davis in pressing for the employment of systematic methods in describing the landscapes with which the geographer has to deal has brought about a more rational treatment, in which due recognition is given to the structure of the area, and the processes which have moulded it, so that land forms are now for the most part described more or less adequately in terms which are familiar to all geographers and which convey definite associated ideas, in the light of which the particular description is adequately appreciated. It has been urged by some that such technical terms are unnecessary and serve to render the writings in which they occur intelligible only to the few; that any one should be able to express his meaning in words and sentences which will convey his meaning to all. There is no great difficulty in doing this, but in such descriptions to convey all that a technically worded account can give to those who understand its terms would be long and involved on account of the numerous related facts which would be included. It is consequently essential in all accurate work that certain terms should have very definite and restricted meanings, and such technical terms, when suitably chosen,

are not only convenient in that they avoid circumlocution, but when used in the accepted sense at once suggest to the mind a whole series of related and dependent conditions which are always associated with it.

The compilation of a glossary of geographical terms has been in progress in this country for many years without having reached finality, and much of the difficulty which has been experienced is doubtless due to the fact that so many words have not been consistently used with a well-defined meaning. Such looseness of expression is more liable to occur in the case of foreign words which have been imported in the first case by writers who are not scientifically trained, and therefore do not use them in connection with a specified set of conditions. This, however, is unimportant if only scientific geographers, when they accept a term as a desirable addition to the geographical vocabulary, will associate it definitely with such conditions and use it consistently in that connection. As an instance I may quote the word "sadd," which etymologically means to block, or stop. This term was naturally and reasonably used to indicate masses of uprooted marsh vegetation which had been carried along by the current and, if checked at a sharp bend or a narrow point of the stream, blocked the channel. So long as it is used in this restricted sense it is a useful term to describe a phenomenon which occurs under certain definite conditions and which leads to equally well-defined geographical results. This use of it is associated with a meandering river-channel in an alluvial flood plain, where shallow lagoons occur, in which such marsh vegetation grows luxuriantly; when this vegetation is uprooted by storms and carried by the rising water into the main stream it provides the drift material which makes up the block or "sadd."

But this term has been extended immoderately to mean the region in which these physical conditions occur, or the type of vegetation which grows under these conditions, and even the type of country where such conditions prevail. One writer has even used the word in describing the fossil vegetation of a character such as is associated with marsh lands.

The crystallization of such geographical terms into true technical terms is an important step in the furtherance of scientific geography, but it must be done by the geographers themselves, and no means of doing this is more fruitful than the work of original research and investigation in definite areas or on specific problems.

It would take too long to discuss each branch of physical geography and indicate the opportunities for individual effort, but what has been said of one may be said of all the others. Not only in all parts of the Empire, but in these islands also there is ample opportunity for the detailed geographical study of single localities or individual phenomena, just as much as in geology, in botany, or in zoology; and it is these separate pieces of work which, when thoroughly carried out and critically discussed, provide the material on which wider generalizations or larger investigations can be based. Herein lies, therefore, the importance of

the prosecution of them by as many workers as possible, and the value of communicating the results to others for criticism and for comparison with the results which they have obtained; for such work, if it cannot be made accessible to other workers in the same and related fields, loses a large proportion of its value.

If we now consider some of the problems of human geography we shall find the need for such systematic study to be even greater; for the variable factors involved are more numerous than in physical geography, and many of them are difficult to reduce to precise statement; the quantitative study of the subject is therefore much more difficult than the qualitative or descriptive, so that the latter is too frequently adopted to the exclusion of the former. The remedy lies, I believe, in individual research into special cases and special areas where the factors involved are not too numerous, where some of them at least can be defined with some accuracy, and where, consequently, deductions can be drawn with some precision and with an accuracy which gives grounds for confidence in the result. The settlements of man, his occupations, his movements in their geographical relations are manifested everywhere, and subjects of study are to be found without difficulty, but their investigation must be based on actual observation, and on data which have been carefully collected and critically examined, so that the subject may be treated as completely as possible, and in such a way that the evidence is laid before the reader in order that he may form his own conclusions.

It is probable that some of the lack of precision which is to be found in this part of the subject is to be attributed to the want of precision in its terminology. For many things in human geography good technical terms are required, but these must be selected by those who have studied the type or phenomenon concerned and have a clear idea of the particular conditions which they desire to associate with the term; this is not the work of a Committee of Selection, but must grow out of the needs of the individual workers.

There is, it must be admitted, no small difficulty in using the same preciseness of method in this portion of the subject as is readily attainable in mathematical geography, and is usually practicable in physiography; but at any rate it is undesirable to indicate any condition as the controlling one until all other possible influences have been carefully examined and have been shown to have less weight than that one which has been selected.

Whether the investigation deals with the settlements of man or his movements and means of communication it is important that in the first instance problems of a manageable size should be undertaken and thoroughly treated, leaving larger areas and wider generalizations until a sufficient stock of thoroughly reliable material which is in the form in which it can properly be used for wider aims is available.

The relation of geographical conditions to small settlements can be

satisfactorily worked out if sufficient trouble is taken and all possible sources of information, both of present date and of periods which have passed away, are utilized. Such studies are of a real value and pave the way to more elaborate studies, but we need more serious study of these simpler cases both to set our facts in order and to provide a methodical classification of the conditions which prevail in this part of the subject. Out of such studies there will grow such a series of terms with well-defined associations as will give a real precision to the subject which it seems at the present time to lack.

The same benefit is to be anticipated from detailed work in relation to man's communications and the interchange of commodities in all their varied relations. Generalized and descriptive accounts are readily to be found, and these are for the most part supported by tables of statistics, all of which have their value and present truths of great importance in geography, but the spirit of active research which aims at clearing up thoroughly a small portion of the wide field of geographical activities has unequalled opportunities in the somewhat shadowy relations between the phenomena which we meet in this part of the subject, for focussing the facts better, and obtaining a more exact view of the questions involved.

Where the geography of States (political geography) is concerned the same need for original investigation as a basis for generalizations may be seen. At the present time there is much said about the various boundaries of States, and in general terms the advantages and disadvantages of different boundaries under varied conditions can be stated with fair approximation to accuracy. But I do not know of many detailed examinations of these boundaries or portions of them where full information of all the factors involved can be found set out in an orderly and authoritative manner, thus forming a sure foundation for the generalized description and providing the means of verifying its correctness or revising it where necessary.

Perhaps there is really more scientific research in geography being undertaken by individuals than I have given credit for, but certainly in geographical periodicals, and in the bibliographies which are published annually, the amount shown is not large; neither is the number of authors as large as might be expected from the importance and interest of the subject and from the activity of those centres where geography is seriously taught. There seems to be no reason why individual research on true scientific lines should not be as active in geography as it is in geology, botany, zoology, or any other branch of knowledge; and, just as in these, the real advance in the subject is dependent on such investigations rather than on travels and explorations in little-known lands, unless these too are carried out scientifically and by thoroughly trained observers who know the problems which there await solution, and can read the evidence which lies before them on their route.

If research in these directions is being actively prosecuted, but the appearance of its results is delayed, let us seek out the retarding causes if there be any, and increase any facilities that may be desirable to assist individual efforts.

Short technical papers of a thoroughly scientific character, such as are the outcome of serious individual research, are, of course, not suitable for those meetings of Geographical Societies where the majority of the Fellows present are not scientific geographers, but should be presented to small meetings of other workers in the same or allied fields, where they can be completely criticized. The reading, discussion, and the publication of papers of this class are for geography a great desideratum, for it is in them and by them that all real advance in the subject is made, rather than by tales of travel, however interesting, if these are not the work of one trained in the subject, having a knowledge of what he should observe, and of what his predecessors have done in the same field. The regional aspect of geography in the hands of its best exponents has given to young geographers a wide and comprehensive outlook on the interaction of the various geographical factors in a region, the responses between the Earth's surface and the life upon it, and the control that one factor may exercise upon another. In this form the fascination of geographical study is apparent to every one, but I sometimes wonder whether the exposition of such a regional study by one who is thoroughly master of the component factors, having a first-hand knowledge of all the material involved, and knowing exactly the reliability of each portion, impresses sufficiently upon the student the necessity of personal research into the details of some problem or phenomenon in such a way as to gain a real working acquaintance with them; or does it on the other hand tend to encourage generalizations based on descriptive accounts which have not been verified, and where coincidences and similarities may be accepted without further inquiry as evidence of a causal connection which may not really exist? I imagine that the student may be attracted by the apparent simplicity of a masterly account of the geographical controls and responses involved, and may fail to realize that geographical descriptions, even though technically phrased, are not the equivalent of original quantitative investigation, either for his own education or as a contribution to the subject.

For these reasons I believe that Societies can do far more good in the promotion of geography as a science by assisting competent investigators, by the loan of books and instruments, and by giving facilities for the discussion and publication of technical papers, than by undertaking the investigation of problems themselves.

Among the earlier Presidential Addresses of this Section some have laid stress on the importance of the recognition by the State of geography in education; others have represented the great part which the Geographical Societies have played in supporting and advancing the

subject; others again have urged the fuller recognition of geography by educational institutions. I would on this occasion attach especial importance to the prosecution of serious research by individuals in any branch of the subject that is accessible to them, to the discussion of the results of such work by others of like interests, and to the publication of such studies as having a real value in promoting the advancement of scientific geography.

SIR AUREL STEIN'S EXPEDITION IN CENTRAL ASIA.*

By the first week of November, 1914, the several parties of my expedition were safely re-united at Kara-khoja, the central oasis of the Turfan depression. A two months' journey had brought us by widely different routes back from Kanchou to this north-eastern corner of Chinese Turkestan. A variety of reasons had induced me to select Turfan as my base for the geographical and archæological labours planned during the ensuing winter. From what my brief visit to Turfan in 1907 had shown me, I could hope that the ruins of Buddhist times preserved there in abundance had not yet been completely exhausted, in spite of their easy accessibility within or quite close to oases near a high-road and of the attention they had received from successive archæological expeditions, Russian, German, and Japanese.

Turfan further offered itself as the most convenient starting-place for the series of tours I wished to organize for the exploration of unknown or as yet inadequately surveyed portions of the Kuruk-tagh and Lop deserts southward. And, finally, geographical and antiquarian interests combined to make me eager for an accurate large-scale survey of the Turfan basin, for it is just there that we find exhibited, within close topographical compass and in a concentrated form, as it were, all those characteristic physical features which make its great neighbour and counterpart, the Tarim basin, so interesting both to the geographer and the historical student.

This detailed survey of the Turfan depression was started on the scale of 1 inch to the mile and with carefully observed contours by Surveyor Muhammad Yakub as soon as he had joined me after a difficult desert crossing from the terminal basin of Hami. A few days later the rapidly increasing cold, felt even here below sea-level, allowed me to send off Rai Bahadur Lal Singh to the Kuruk-tagh, or "Dry Mountains," where difficulties arising from the want of drinkable water could be met only by the use of ice from salt-springs—or of snow if such happened to fall.

* Communication from Sir Aurel Stein, K.C.I.E., PH.D., D.SC., dated "Camp Bostan-Arche, Ulughart Valley, July 10, 1915." See *Geographical Journal*, vol. 45, p. 405.

By then the archæological labours had already commenced which were to keep me and my remaining two Indian assistants busy for the next three and a half months.

Their first scene was the ruined town known as Idikut-shahri. It immediately adjoins the large village of Kara-khoja and has long ago been identified as the site of Kao-chang, the Turfan capital during T'ang domination (7th to 8th century A.D.) and the subsequent Uigur period. Within an area nearly a mile square and enclosed by massive walls of stamped clay there rise here the ruins of very numerous structures built of sun-dried brick or clay, almost all Buddhist shrines and several of imposing dimensions. For generations past the cultivators of the adjoining villages have quarried the *débris*-filled ruins to obtain manuring earth for their fields. The excavations repeatedly made here by Profs. Grünwedel and Von Lecoq between 1902–1907 had induced the villagers to extend their destructive operations and to carry them deeper in the hope of securing manuscript remains and antiques as valuable by-products for sale to Europeans and their agents. But there still remained some ruins where the deeper *débris* strata had escaped exploitation. Their systematic clearing brought to light a variety of interesting remains in the shape of fresco pieces, fragments of paintings on paper and cloth, stucco relievos and the like illustrating Buddhist art at Turfan. We also recovered manuscript remains in the Uigur, Tibetan, Chinese, and Manichæan scripts. Among individual finds of interest may be mentioned a hoard of well-preserved metal objects, including decorated bronze mirrors, ornaments, vessels, etc. It derived special interest from the large number of coins found with it, which enabled me to fix with approximate accuracy the date of its deposit in Sung times. Our work included an exact plan of the whole site.

After visiting smaller ruined sites in the eastern portion of the Turfan basin, I started towards the close of November excavations in the picturesque gorge of Toyuk. There the precipitous cliffs, rising above the small stream which waters a prosperous little oasis famous for its grapes, are honeycombed by numerous rock-cut caves once used for Buddhist worship. Ruins of small cellas occupy narrow terraces where the slopes are less steep. Important finds of manuscripts had been made by the second German expedition at the most conspicuous of these shrines, as the great quantity of fragments of Chinese Buddhist texts left lying among the *débris* still attested. This had stimulated the monkey-like emulation of native searchers for antiques, with the result of terrible havoc being wrought among the ruins previously left more or less untouched. We succeeded, however, in tracing remains of small shrines lower down which had escaped such destruction owing to the heavy covering masses of *débris*. Fortunately here as elsewhere about Turfan the employment of large numbers of diggers was easy, conditions being so different from those to which my previous work at sites far away from habitations and water had

accustomed me. In the end our work at Toyuk was rewarded by the recovery of a considerable quantity of fine fresco paintings and stucco relievos. There were finds, too, of fragmentary Chinese and Uigur texts.

By the middle of December I was able to leave Toyuk for the important site below Murtuk village. There one branch of the stream watering the Kara-khoja oasis breaks in a narrow wild gorge through the barren hill range overlooking the Turfan depression from the north. A conglomerate terrace on the west bank bears an extensive series of ruined Buddhist temples partly cut into the rock face. By the richness and artistic merit of their fresco decoration they surpassed any remains in the Turfan region. In 1906 these big wall paintings representing scenes of Buddhist legend and worship in great variety of subject and style had been carefully studied by Prof. Grünwedel, a leading authority on Buddhist iconography, and a considerable selection of fresco panels was then removed to the Ethnographical Museum at Berlin. Exposed for long centuries to casual injury at the hands of iconoclast Muhammadan visitors, the frescoes had suffered even more during recent years from natives, who in vandal fashion would cut out small pieces for sale to Europeans. The near risk of complete destruction was only too obvious, and I accordingly decided to save as much as possible of these fine-art remains by careful systematic removal. Fortunately I had trained help available for this long and difficult task in the person of my "handy man," Naik Shams Din, of the 1st Sappers and Miners, and through his devoted energy and technical skill the work was in the course of six weeks successfully accomplished according to carefully drawn plans.

While it was still proceeding I could apply myself to the excavation of smaller Buddhist ruins near Murtuk, and then to a task which proved as fruitful as it was in some ways unpleasant. On the gravel-covered waste between the debouchure of the gorge descending from Murtuk and the village of Astana which adjoins Kara-khoja from the west, there extends a vast ancient burial-ground marked by small stone mounds which low lines of embanked gravel enclose into scattered groups. Below these mounds there lie tomb chambers cut into the underlying hard sandstone, with a narrow rock-cut passage leading deep down to the entrance. Most of these tombs appear to have been searched for valuables during the last Muhammadan rebellion and perhaps also earlier. But drift-sand had completely closed up their approaches, and the attention of local antique-hunters had turned to them only during the last few years. These recent operations had not proceeded far, and anyhow assured us of the absence of any local prejudices.

The systematic search we effected of very numerous tombs has conclusively shown that this cemetery belongs to the early T'ang period when Kao-chang was an important administrative centre and garrison of the Chinese holding Eastern Turkestan. Chinese inscriptions on bricks have furnished exact dates, names of persons, etc. This is not the place

to give details as to interesting burial customs revealed by these tombs or the remarkable state of preservation in which most of their contents and tenants were found. This state is fully accounted for by the Turfan climate, which vies with that of Egypt in dryness. It must suffice to record that the archæological spoil has been abundant, and strikingly illustrates the position which Turfan occupied at that period as a place of trade exchange between Western Asia and China. Finds of Byzantine and Sassanian coins used much in the fashion of the classical obolus were frequent. Equally curious is the abundance of brocades and other decorated silk fabrics showing designs usually associated with Persian work of Sassanian times. The stucco figurines, miniature household implements, articles of food, clothing, etc., deposited with the dead acquaint us with many aspects of the daily life led in Turfan at that period. There were paintings on silk, too, and manuscript records in plenty.

However interesting and to me novel this work was, I felt heartily glad when the time came to exchange this search of the dead's habitations for exploratory tasks in the desert. Towards the close of January Lal Singh had rejoined me from the "Dry Mountains," having accomplished important survey work in the face of great physical difficulties. In accordance with my instructions, he had started triangulation after reaching Singer, the only permanent habitation in that vast expanse of barren plateaus and hills, and carried it south-east to the vicinity of the Lou-lan sites in the wind-eroded Lop desert. There he had waited patiently for a week amidst icy gales, with temperatures falling well below zero Fahrenheit, until the atmosphere had cleared and allowed him to connect his triangles right across the Lop desert with high snowy peaks of the Kun-lun some 150 miles south which had been fixed by his triangulation of 1913. It was my hope to get this link with the Indian triangulation system extended later on to the Tian-shan range in the north.

Accompanied by Abdur Rahim, the experienced hunter of wild camels from Singer, who had proved so useful to us a year before, Lal Singh had then pushed into the unexplored and absolutely sterile region to the north-east of Altmish-bulak until the total exhaustion of his fuel supply obliged him to turn westwards again after having reached close to 92° long. On his return journey he picked up an old desert track once used by hunters of wild camels from Hami before certain salt springs had dried up, and followed it through to the salt marsh which forms the deepest portion of the Turfan basin. Numerous observations made there with the mercurial barometer will, I hope, permit its depression below sea-level to be determined more accurately than had been possible so far.

By the first week of February Lal Singh was eager to take the field again in the Kuruk-tagh, and by dint of great efforts we had completed the packing of our plentiful "archæological proceeds." On February 6 I started my big convoy of antiques making up fifty heavy camel-loads for

its two-months' journey to Kashgar, and on the same day Afrazgul Khan, my zealous and ever-active assistant from the Khyber Rifles, was sent off to the Lop desert for a supplementary survey of the Lou-lan region and the ancient dry lake-bed east and south. I myself was detained ten days longer by arrangements for the completion of the large-scale map of the Turfan depression and by the collection of supplementary data bearing on its extant irrigation resources. The fact that now the greater portion of the cultivated area is dependent on *Karezes* or springs tapped by underground canals, a system introduced into Turfan only in the eighteenth century, clearly proves the diminution which has taken place since Buddhist times in the water-supply above ground. A detailed survey was also made of the curious site of Yar-khoto, where a maze of ruined dwellings carved out of the loess soil of an isolated and naturally strong plateau represents the remains of the Turfan capital of Han times.

On February 16 I set out myself for the Kuruk-tagh, and after securing from Singer Abdur Rahim's youngest brother as guide, visited several localities in the mountains westwards where traces of earlier occupation were reported. In the course of this tour I was able to map a good deal of ground which had remained still unsurveyed. By its succession of remarkably rugged ranges and deeply eroded valleys it presented a striking contrast to the plateau-like character borne by most of the Kuruk-tagh eastwards. The presence of scanty grazing in the higher valleys and even of some tree-growth helps to explain the reference which the Han Annals make to the westernmost Kuruk-tagh as a sporadically inhabited region.

By the first week of March I had made my way south-eastwards to the salt spring of Yardang-bulak at the extreme foot of the Kuruk-tagh, where it overlooks the dried up ancient river-bed first traced by Dr. Hedin which once carried the water of the Konche-darya to the Lou-lan sites. The ice-supply taken from there allowed me to make a tour in the waterless desert south. There I mapped the ancient river-bed, still clearly distinguishable between the belt of dead trees lining its banks, over the last portion of its course left unsurveyed last year. I also explored two ancient cemeteries of small size on clay terraces rising above the wind-eroded riverine plain. The finds closely agreed with those made in graves which I had examined the year before in the extreme north-east of Lou-lan. The bodies undoubtedly belonged to the autochthone population of herdsmen and hunters inhabiting this tract until its final drying-up in the fourth century A.D. The objects found with them strikingly demonstrated the difference in civilization and modes of daily life between the semi-nomadic Lou-lan people and the Chinese frequenting the ancient high-road which led along the dried-up river westwards.

On my return to Yardang-bulak I was greatly relieved by Afrazgul safely rejoining me. He was a week overdue, and, considering the forbidding nature of the ground my plucky assistant and his three Turki followers

had to traverse, there had been cause for anxiety. After gaining Altmish-bulak by the most direct route, and taking his ice-supply there, he had explored certain ancient remains in the extreme north-east of the once watered Lou-lan area which on our hazardous march of last year we had been obliged to leave unexamined. He then retraced the ancient Chinese route to the point where it crossed the dry lake-bed of hard salt, and thence surveyed the shore-line of the latter until he reached the edge of the area where the spring floods of the Tarim finally lose themselves in lagoons and marshes. From there he turned north, and, after tracing more ruins along the ancient dry river branch discovered last year, gained the foot of the Kuruk-tagh across an area of formidable high dunes. Apart from interesting archæological finds Afrazgul brought back from this exceptionally difficult exploration a detailed plane-table survey which, in conjunction with last year's mapping, will help to show the so-called Lop-nor problem in a new light.

Then we moved west to Ying-pên, where the Turfan-Lop track crosses the ancient bed of the Konche-darya. A short halt there enabled me to explore the remains of an ancient fortified station and neighbouring small temple site, first noticed by Colonel Kozloff and Dr. Hedin. Finds of fragmentary Kharoshthi records on wood and of coins proved that the ruins dated back to the early centuries of our era when the ancient Chinese high-road passed here. The station guarded an important point on the route, and must have held a Chinese garrison, as proved by the remains which came to light from some well-preserved tombs near by.

Starting from Ying-pên for Korla, I first traced in the desert westwards the ancient bed by which the waters of the Konche-darya had once passed into the "Dry River" of Lou-lan. I then explored the remains of an ancient line of watch-stations extending along the foot of the Kuruk-tagh, on a route which Dr. Hedin had first followed in 1896. The constructive features observed in these watch towers, some of them remarkably massive and well-preserved, showed the closest resemblance to those with which I had become so familiar in the course of my explorations of the ancient Chinese *Limes* of Kansu. It appears to me, hence, highly probable that these towers were built soon after the date (*circ.* 100 B.C.) when the Emperor Wu-ti established his wall and line of posts along the route leading from Tun-huang towards Lou-lan. But the line marked by these towers must have continued to serve as a high-road down to T'ang times, as was proved by the finds we made in clearing the refuse heaps near them. Distinct evidence showed that the towers had been intended chiefly for the communication of fire-signals, as mentioned in the early Chinese records from the Tun-huang *Limes*. This purpose is easily understood, as it was mainly from the direction of Kara-shahr and Korla that the Hun raids must have proceeded which we know to have threatened more than once the Chinese hold upon Lou-lan and the security of the route leading through it.

I reached the large oasis of Korla on the last day of March, and there I was soon joined by my several surveying parties. Lal Singh had had to contend with exceptional difficulties, both from the very broken nature of the ground and adverse atmospheric conditions—all through March we had suffered from a succession of dust-storms. Yet he had succeeded in carrying his triangulation from Singer through the western Kuruk-tagh to the snow-covered peaks north of Korla. Thus the Tian-shan range has been linked with the system of the Trigonometrical Survey of India.

After a short and much-needed rest at Korla, we started in three separate parties for the long journey to Kashgar. Lal Singh was to keep close to the Tian-shan in order to survey as much of the main range as the early season and the available time would permit. Muhammad Yakub was sent with the camels across the Konche and Inchike rivers to the Tarim, the course of which he was to survey to the vicinity of Yarkand. I myself was compelled by antiquarian reasons to keep to the line of oases which extends along the south foot of the Tian-shan, and through which the great caravan route passes just as it had in ancient times. This journey, over 900 miles in length, offered plentiful opportunities for interesting observations on the historical geography and the present physical conditions of this northern edge of the great Turkestan desert basin. This is not the place to record them. But I may mention at least that remains of the ancient Han route could be traced as far as Kucha.

Making this historically important oasis my base, I spent some busy weeks in surveying, with Afrazgul's help, both its actually cultivated area and that which numerous ancient sites scattered in the scrubby desert around prove to have once belonged to it. This survey, attended also by archæological finds of interest, has convinced me that the area under cultivation in Buddhist times was greatly in excess of the extant irrigation resources, of which we secured careful measurements. That the discharge of the rivers irrigating Kucha has diminished considerably since T'ang times seems to me quite clear. But to what extent this "desiccation" was the direct cause for the abandonment of once irrigated areas and at what particular periods it proceeded are questions to which the antiquarian evidence at present available does not supply a definite answer.

At Aksu I was met by Lal Singh, who had managed at three points to carry his plane-table survey up to the snow-covered watershed of the Tian-shan. Sending him westwards by a new route between the unsurveyed outer ranges of Kelpin, I moved by rapid marches to Kashgar, where I arrived on May 31. Colonel Sir Percy Sykes, who had temporarily replaced there my old friend Sir George Macartney as British Consul-General, offered me the kindest hospitality and help. The safe repacking of my collection of antiques, some 180 cases, for its long

journey across the Karakoram to Kashmir, and a host of other practical tasks, kept me hard at work all through June. In the meantime I had the great satisfaction of receiving through the kind offices of H.E. Sir George Buchanan, H.B.M.'s Ambassador at Petrograd, the final permission of the Russian Government for my long-planned journey across the Pamirs and through the mountain tracts north of the Oxus. In a few days I propose to set out on this journey, which is to serve mainly researches on the historical geography and archæology of those regions. In the autumn I hope to follow them up by similar work in easternmost Persia.

[The following is an extract from a letter dated "Camp Kara-Chem, Pamirs, August 8, 1915"]:—

I was able to start for the Pamirs by the first week of July. On my way I stopped for "daffar" work at Bostan-arche, a delightful spot below the Ulugh-art, with fir forest and quite alpine surroundings, which would make a splendid "hill station." I made my way north to the Alai, and am now proceeding from there along the grand snowy range which forms the western rim of the Pamirs towards the Great Pamir source of the Oxus. I propose to follow the latter down through Wakhan to Khorok, and thence to visit Roshan, Darwaz, Karategin before going to Bokhara and the railway. About the end of October I may hope to reach Meshed. The winter I propose to spend in Seistan, and by March I hope to return to India, if all goes well. I have asked for furlough to take me home in the spring and enable me to complete "Serindia," the final report on my second journey. I have met with nothing but kind help since I crossed the Russian border, and feel elated by the chance of seeing so much of new and fascinating ground. Some of it is decidedly rough to travel over, but my leg has so far stood the climbs and long marches quite well.

FURTHER NOTES ON THE PHYSIOGRAPHY OF PORTUGUESE EAST AFRICA, BETWEEN THE ZAMBEZI RIVER AND THE SABI RIVER.

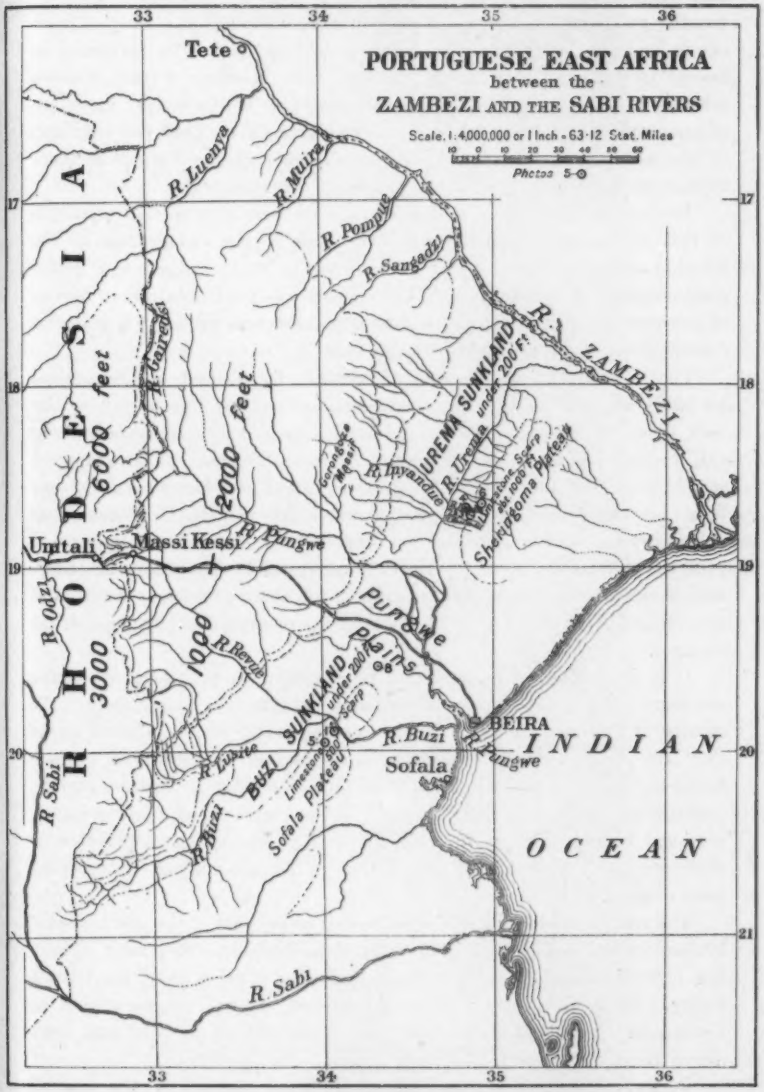
By E. O. THIELE, M.Sc., F.G.S.

Introduction.

Some of the major physical features of a portion of Portuguese East Africa south of the Zambezi River, and their probable relation to tectonic factors were described recently by Mr. R. C. Wilson and myself in this *Journal*.* The observations embodied in that account had then extended over three seasons of field work in connection with the mineral

* *Geogr. Journal*, January, 1915.

survey of the Companhia de Moçambique, and they led us to emphasize the view which had gradually matured in our minds that many of the



main surface features of that region were dominated by tectonic movement and fracture. In other words, while realizing the important part

played by ordinary erosion acting on rocks of various hardness and structure, we felt convinced that some of the important plateaus, scarps, and depressions were largely controlled by tectonic factors. Thus the frontier scarps of the Rhodesian plateau were described as mainly of fault origin and the lower Zambezi valley as a sunk land. The evidence in favour of tectonic control was in most cases based on physiographical features in conjunction with geological structure, but in several instances physiographical evidence was all that was available. Thus the ascribing of the features of Urema sunkland and the Sheringoma scarp to tectonic origin was based mainly on physiographical considerations.

During the recent field season of 1914 we were able to visit a portion of this region again, and devoted some time to the examination of the Sheringoma scarp, where we were fortunate in finding conclusive geological evidence of faulting. Further support was thus obtained in favour of the view advanced that the Urema depression was probably a southern continuation of the great African rift zone.

The same field season embraced another large tract of the coastal lowlands south from the Beira-Mashonaland railway line as far as the Sabi River, and included also a considerable strip of the hill country along the western boundary of the plains. Many additional physiographical studies were therefore provided. As the work of the mineral survey has been suspended on account of the war, and Mr. R. C. Wilson has volunteered for active service, there does not seem to be any immediate prospect of pursuing these physiographical studies. The following observations are therefore recorded to supplement those previously given, and accordingly bear mainly on the relation of the tectonic and physiographical features.

It is frequently very difficult in physiographical problems to ascribe the correct share due to tectonic and structural factors respectively. As structural features are more generally recognizable and capable of proof they are perhaps more frequently emphasized in the study of surface features; but it appears to be beyond question, that in certain regions tectonic movement is sufficiently rapid and powerful to dominate ordinary erosional factors. In this discussion, therefore, though the importance of structure has not been lost sight of that of tectonic control has received some emphasis.

The region embraced in this description forms part of the great coastal lowlands which consist mainly of featureless, bush-covered plains. There are, however, some extensive treeless areas also, notably along the Urema valley. That part most worthy of mention is the Sungwe region in Gorongoza where countless mobs of game are still to be seen and lions are extremely numerous.

Perhaps the most striking physiographical feature of the coastal lowlands is the wide shallow depression which takes the form of a trough in the north and in the south. Its western boundary is from 60 to over

BUZI VALLEY, LOOKING NORTH-WEST, SHOWING LIMESTONE SCARPS WHERE THE RIVER LEAVES THE PLAINS TO THE WEST AND INTERSECTS THE SOFALA-BUZI PLATEAU.

CLIFFS OF TERTIARY LIMESTONE, KUNDWI RIVER, SHERINGOMA, SHOWING ALSO SURFACE OF THE PLATEAU NEAR THE WESTERN SCARP.

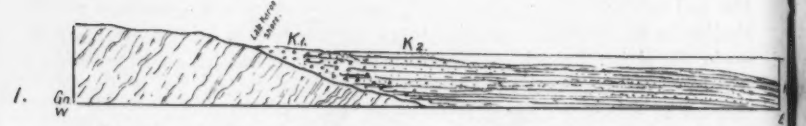
UNDERGROUND PASSAGE LEADING OUT ON TO CLIFF, KUNDWI VALLEY, SHOWING ALSO SINK HOLE IN THE ROOF.

80 miles from the coast, and consists of a clearly defined scarp rising suddenly from about 200 to over 1000 feet above sea-level. This is the eastern edge of the 1000–2000 feet shelf of crystalline rock previously described. Its southern portion was examined last season south from the railway line for a distance of about 100 miles. Its features are similar to those noticed previously to the north. All the rivers issue on to the plains through entrenched gorges, with numerous rock bars and rapids. Their character suddenly changes from active steeply graded courses to sluggish meandering streams, wandering over plains of sand and clay. This scarp continues in a direction from north-east to north-north-east for a distance of nearly 200 miles, and the question of its origin calls for some consideration. Geologically it consists almost entirely of gneiss, but it is noteworthy that basic dykes conforming closely in direction to that of the scarp are of frequent occurrence in this zone, but are rare to the west over a distance of about 100 miles until the frontier region is reached, where they are more abundant again. As a rule there is no rock showing on the plains to the east, for a deposit of recent sand and clay of unknown depth covers everything. Along the northern margin, however, in Gorongoza, basaltic hills become frequent, associated also with a sedimentary series of undetermined age, but probably Upper Karoo. These sediments have only a narrow outcrop along the margin of crystalline rocks and soon disappear under the recent deposits of the plains. They consist of coarse reddish grits, shales, and conglomerates which have so far yielded no fossils, but are continuous with similar beds in the Zambezi basin which appear to form the uppermost portion of the Karoo series. The deposits are of a coarse littoral character and mark, therefore, proximity to an old shore-line. The above evidence thus indicates some important structural features which suggest also the probability of associated tectonic movement; but it is not conclusive and other interpretations of the evidence are possible.

In the discussion of the Urema trough, given later, alternative views are represented diagrammatically, both of which, however, include a certain amount of relatively recent faulting along the eastern side of the trough (Figs. 1–5). Though no actual fault sections have been noted in the western side it is difficult to account for the physiographical features by structural factors alone. The scarp may either be regarded as of recent development or of Cretaceous or Karoo age and due then in the two latter cases to the stripping off the softer littoral sediments by recent erosion. In any case it seems most probable that a certain amount of tectonic action must be attributed to its formation, and the view that appears to harmonize most with the requirements is that there has been recent dislocation along an old tectonic line.

The eastern boundary of the depression under discussion is well defined in the north over a distance of more than 60 miles by the straight scarp of the Sheringoma plateau, and a similar but lower scarp has been traced

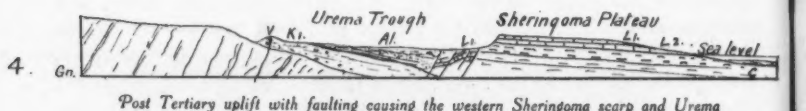
in the southern region through Western Sofala across the lower Buzi for a distance of more than 50 miles. In the central portion, however, there is no eastern wall, its place being taken by the vast plains of the Pungwe,



Late Karoo shoreline. Lacustrine deposits,—red grits, sandstones, shales and conglomerates.

U. Cretaceous shoreline,—cut out of soft Karoo sediments.
Sandy marls and limestone followed by Tertiary limestone.
Post Karoo Volcanic activity indicated near the old Karoo shoreline.

U. Cretaceous and Tertiary coastline may have approached practically to the crystalline rocks. the limestones and marls passing gradually into coarse littoral deposits.



Post Tertiary uplift with faulting causing the western Sheringoma scarp and Urema depression,—sagging without faulting along the western side.

Post Tertiary uplift with faulting on both sides of the trough. That on the western side being assumed.

DEVELOPMENT of the UREMA TROUGH.

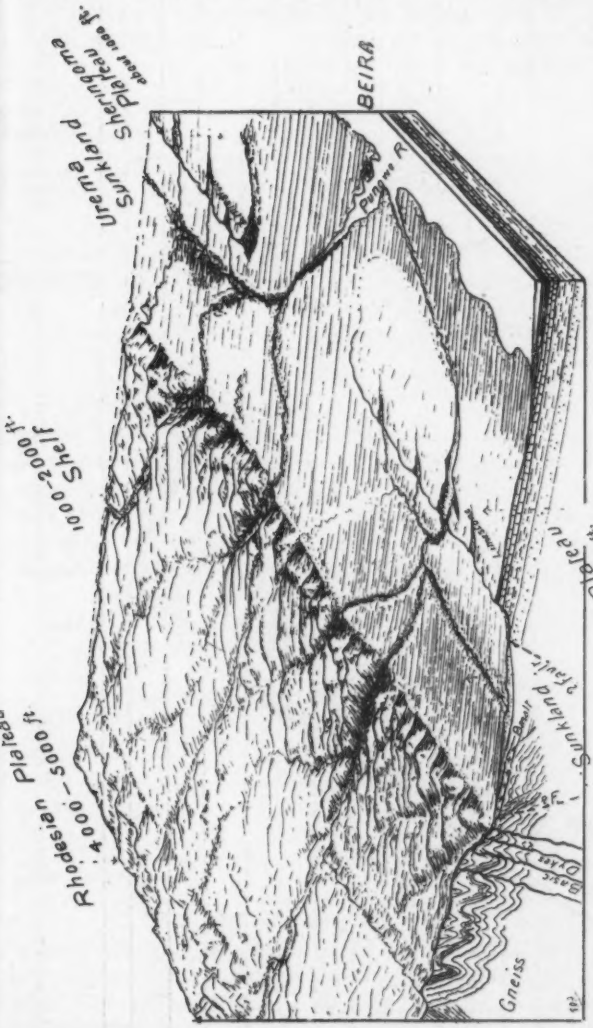
Representing the probable successive positions of old coast lines and corresponding extent of various strata. 2 and 3 are alternative views with regard to the Cretaceous shore, and 4 and 5 concerning the western side of the Urema trough.

	K 1.?	*Late Karoo Conglomerate.*	*L 1. Miocene Limestone.*
Gn. Gneiss.	*K 2.?*	*.. .. Sandstone.*	*L 2. Eocene.*
V. Volcanic. (Basaltic)	*K 3.?*	*.. .. Shale.*	*C. Cretaceous.*
		Al. Recent Alluvium.	

which extend continuously from the western margin of the lowlands to the sea, a distance of more than 60 miles in a straight line.

The Urema trough and its eastern wall formed by the scarp of the

Sheringoma plateau were briefly described in the previons article which appeared in this *Journal*, but some additional exploration in this region during the past season has provided some interesting and important



Block diagram showing low coastal plains, limestone plateaux, sankiandu and inland peneplain, 1000—2000 ft. with recuved river system. The frontier scarp of the Rhodesian Plateau is also shown.
Fig. 6.

evidence bearing on the physiography of the area. One noteworthy feature of the Urema depression is that it is annually flooded over wide areas forming a series of shallow temporary lakes, with continuous water

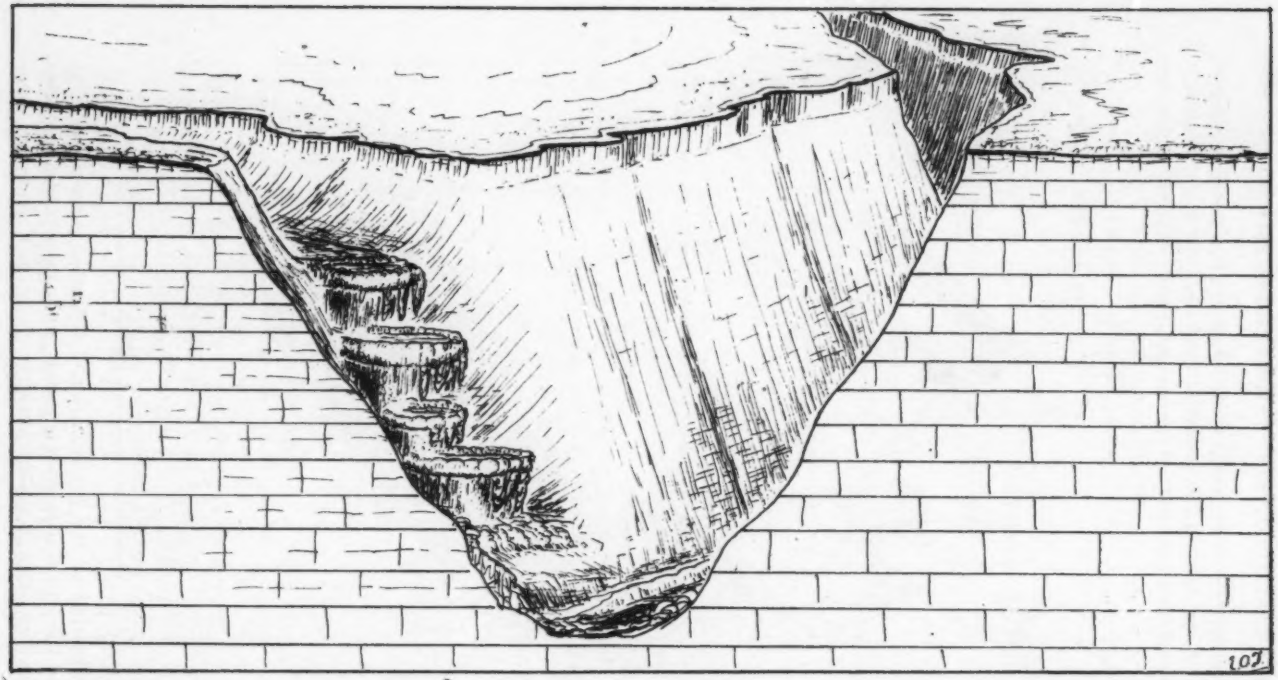


Fig. 7.

Diagrammatic Sketch, Masikedzi R. Sheringoma with lateral hanging valley due partly to the development of travertine terraces at the junction which have retarded the corrasive action of the tributary.

communication between the Zambezi and the Pungwe, a distance of more than 100 miles. The water drains off rapidly as the dry season advances, and the tough black clay, which covers wide areas, soon becomes hard baked in the sun and intersected by wide gaping cracks.

The Sheringoma scarp is remarkably straight and free from outliers to the west, and the tributaries of the Urema draining from the plateau

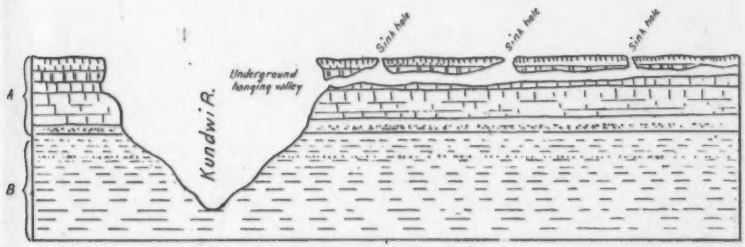


Fig. 8.
Underground Hanging Valley. Kundwi R., Sheringoma.
A. Limestone. B. Sandy and calcareous clays.

have cut narrow steep-walled canyons of rapid grade through the Tertiary and Cretaceous limestones and marls. These valleys provide some striking scenic effects and reveal some fine geological sections. Only a few of these have yet been traversed. The Kundwi, however, shows some important sections, and just where it issues on the plains, close to the base of the scarp, there is a fine fault section (see Fig. 9). The Miocene

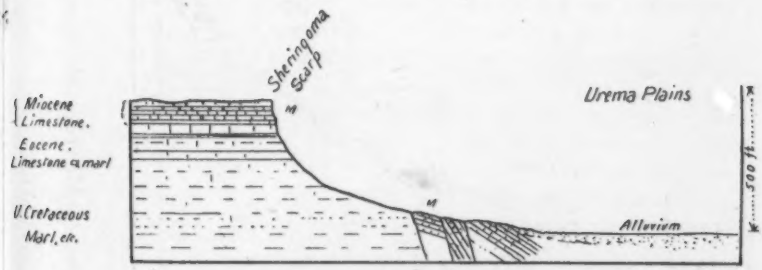


Fig. 9.
Fault Section. Kundwi R., Sheringoma.

foraminiferal limestone, which occurs on the plateau at least 500 feet above, is here seen to be dipping at angles from 30° to 50° to the north-west. The displacement is therefore at least 500 feet. The character of the fault suggests one of considerable extent, and though the other streams have not yet been explored in parts corresponding to this fault line, it is highly probable that many would yield similar evidence. The age of the fault is clearly post-Miocene, and the Sheringoma scarp is

almost certainly a true fault scarp. Its age based on physiographical evidence is probably of recent date. The existence of this fault was previously inferred on physiographical grounds; it was therefore gratifying to find subsequently such clear geological support. The Sheringoma region exhibits many of the interesting surface features that are common to limestone country, but two less usual forms are worthy of mention; these represent special cases of hanging valleys, one of which was noted in the valley of the Kundwi and the other in that of the Masikedzi. These streams, like most of those draining west into the Urema, follow shallow channels on the plateau for a few miles and then drop into deep narrow fissures in the limestone which soon widen out into deep gorges with vertical and overhanging cliffs.

The instance in the Masikedzi valley is at the junction of a tributary with the main stream. The over-deepening of the main channel is due in part to its greater volume, but the corrasion of the lateral stream at its junction has been retarded by a fine succession of travertine terraces, like so many swallows' nests one above another, illustrated diagrammatically in Fig. 7.

The other case in the Kundwi valley is caused by the junction of an underground channel with the main stream. The tributary in this instance is a small intermittent one, and the over-deepening of the main stream, therefore, is due almost entirely to its greater volume (see Fig. 8).

The Buzi Depression and Scarp of Western Sofala.

This region repeats in the main the features of the Urema and Sheringoma but with some differences. The plateau of Buzi and Western Sofala is not isolated like that of Sheringoma, as it sweeps round and continues uninterruptedly to the west-south-west into Rhodesia, merging into the sandy gravel-capped lowlands of the Sabi basin. It is, moreover, much lower, barely reaching 500 feet above sea-level and is also crossed by a steep walled gorge, for the Buzi, after flowing parallel with the scarp for some distance, suddenly turns and crosses it.

The straightness of the western scarp and the general north-north-easterly direction are features resembling closely those of Sheringoma; the western streams, however, are not so numerous nor so well developed, and no fault sections have yet been noted. Both plateaus shade off gradually into the great central plains of the Pungwe. The general features of the whole area are represented in Fig. 6. The sudden change in character and in direction of the lower Buzi valley is of interest. It suddenly leaves the wide shallow trough it occupies to the west of the limestone scarp and follows a relatively narrow channel bounded by limestone cliffs about 200 feet high for 8 to 10 miles. These features are illustrated diagrammatically in Fig. 6, and are capable of being interpreted in different ways.

1. Differential erosion due to a stream crossing country composed of

MIOCENE LIMESTONE, KUNDWI RIVER, AT THE BASE OF THE SHERINGOMA SCARP: TILTING OF THE STRATA DUE TO FAULTING.

SHALLOW VALLEY, SHERINGOMA PLATEAU, IN MIOCENE LIMESTONE, DROPPING INTO DEEP FISSURE WHICH SOON WIDENS INTO A NARROW CANYON.

alternating strips of hard and soft rocks generally results in a succession of features similar to those represented here. In other words, the origin may be purely structural. Unfortunately the depression to the west shows few sections of any importance, for its surface is covered with recent drift and alluvium.

2. River capture caused by the headward erosion of one stream into the basin of a less active one will frequently result in the development of features similar to those under discussion.

3. Differential uplift or warping, with or without faulting, will also produce similar results provided the movement is not sufficiently rapid to divert the course of the stream.

The detailed structure of the area is not sufficiently well known to afford conclusive evidence on this question, but the close resemblance of the features with those of Sheringoma where faulting has been observed, together with the fact the two scarps are on the same line, strongly suggests a similar origin for both. The Buzi-Sofala scarp is therefore tentatively regarded as of fault origin.

The absence of any scarp features in the lower Pungwe region may be accounted for in several ways: either the uplift which raised the areas to the north and south did not affect the central zone, or if so, the erosion of the Pungwe has been many times more rapid and extensive than elsewhere, for the character of its wide swampy plains is in striking contrast to the youthful features of the Buzi Gorge.

It seems probable then that the orogenic movements affecting the coastal lowlands were of an undulatory character, the central or Pungwe portion partaking of a downward warping, and this may be causally connected with the heavy sedimentation of the Pungwe estuary.

The features of the broad coastal lowlands under consideration correspond approximately with what Prof. W. M. Davis * has described as a belted coastal plain; that is, it is divided into three longitudinal belts, the innermost consisting of a lowland depression of soft strata, the middle an upland of harder rocks, and the outer belt a smooth lowland. In the case of the lowlands of Portuguese East Africa, however, the uplift has been accompanied by differential movement and faulting which has accentuated the zonal distribution of the rocks, thus assisting the development of features which in some cases may be the result of erosion alone.

Many interesting physiographical problems still remain to be solved in this region, but much more detailed exploration is necessary before they can be satisfactorily considered. One of these may be briefly referred to in concluding.

The impression gained by rapid traverses over the vast plains of the

* 'Physical Geography,' p. 132, Fig. 82. Ginn & Co., Boston, U.S.A., and London.

Urema was that they may represent the site of a filled-up lake or series of lakes. It must be admitted, however, that at present there is not much field evidence in support of this view. No lake terraces have been observed, and nothing is known concerning the nature of the deposits underlying the superficial cover of sand and clay.

Summary of Conclusions.

The coastal lowlands form an imperfectly belted coastal plain 80 to 100 miles in width. Its innermost longitudinal lowland has no eastern wall in the central portion, for the middle upland belt of limestone rocks, which is well developed in Sheringoma and Western Sofala, is replaced by the low plains of the Pungwe in the central portion.

Downwarping of this region may be the explanation of this feature, probably causally connected with the heavy sedimentation in the vicinity of the Pungwe estuary. Though the belted structure of the lowlands may account largely for the features developed, it is certain that in the Urema region, and probably in the Buzi depression to the south, it has been assisted by tolerably recent faulting.

The line of this depression being a direct continuation of the Nyasa-Shire tectonic line suggests the probability of a synchronous control. The surface features here, however, are affected to a much less extent, indicating probably that the strength of the tectonic dislocation was dying out to the south.

TWO IMPORTANT MAPS FROM THE SURVEY OF INDIA.

Tibet and Adjacent Countries, 1 : 2,500,000.
Carte Internationale du Monde au 1,000,000e. North E. 43, Bombay.

A good map of Tibet and the adjacent countries has long been needed. Since the last edition of the Society's map of Tibet was published in 1906 much fresh information has been obtained which could scarcely have been shown upon the relatively small scale of that map. Moreover, it would hardly have been possible to undertake successful revision, inasmuch as the officers of the Survey of India have done far more than any others in the exploration of Tibet, and an important part of the new information remained inaccessible in the Survey Office at Dehra Dun. There alone was it possible to undertake the task of compiling a map such as that now under review.

The new map, on the scale of 1 : 2,500,000, is bounded by parallels 44° N. and 26° N. and by meridians 72° E. and 102° E., and is printed

in four sheets. The projection is not stated, but it is apparently a conic with two standard parallels.

It is needless to say that the compilation has been carried out with great care and skill; that the selection of place-names has been made judiciously; and that the map is full of new and interesting material. The feature which will provoke most interest and arouse most discussion is the representation of relief. The scale of layer colouring running up to a brilliant red is already familiar in the publications of the Survey of India; and when extreme heights are not too frequent the effect is excellent. It must be confessed, however, that when the country to be represented is Tibet, and the whole central part of the map is covered with brilliant red, there may be two opinions as to the wisdom of the choice of colour scale.

The problem which the Survey of India have set themselves in the production of this map is the representation of the most violent relief upon the surface of the Earth. The ground to be shown ranges from Mount Everest, 29,000 feet above, to the depression south of the Tian Shan range, several hundred feet below sea-level. Moreover considerable stretches of the country are under perpetual snow, which, in accordance with the recent decision of the International Map Conference, is left white, whereby the contrast is greatly exaggerated in spite of the blue form-lines which are where possible shown upon the snow. Where the snowline descends below 15,000 feet none of the brilliant red appears; and thus the great mountain Tengri Khan, 23,600 feet high, is not made sufficiently conspicuous. It is doubtful whether a solution can be found to reconcile the conflicting ideals of representing increasing height by increasing intensity of colour, and at the same time showing the limits of perpetual snow.

Contours are drawn and the layer tints are changed at 250, 500, 2000, 3000, 6000, 10,000, and 15,000 feet. The colour scale approximates in its lower ranges to that of the London Conference of the International Map; in the higher ranges to that which was adopted at the Paris Conference of 1913, but with a tendency "vers le rouge" rather than "vers le marron," which latter found more favour in Paris. The yellow tints of the old London colour scale have a decided use on this map and form a pleasant transition between the green and the brown which is lacking in the second map to be described.

The map is described as a rough provisional issue, and may therefore be discussed as an experiment, in the hope that variants may be produced for comparison. It would, for example, be very interesting to see the effect of hill shading, especially on the snow; or to try to carry the contours right up at a uniform interval, even though the interval must necessarily be a large one, and auxiliary contours would be required below 2000 feet. It might be worth while to try red contours on the snow above 15,000 feet, or alternatively, white contours cut into the red, to

maintain the colour scale while indicating the snow. Progress in the experiment must be gradual, as contours become more precise.

In view of future editions it may be noted that the limits of snow seem to be incorrect about the Shyok Valley and east of Kangchenjunga; that the large title breaks into the mountain range unnecessarily; and that the numerous spaced-out names might perhaps be shown to more advantage as an index diagram. The name "Chinese Empire" survives though the date of the map is 1914.

The first Indian sheet of the International Map should receive a cordial welcome. An attached memorandum explains that the Survey of India was already committed to a series on the scale of 1/M, but covering $4° \times 4°$ instead of $4° \times 6°$, and with heights in feet instead of metres. These form the key to the whole system of numbering and arrangement of the Indian topographical maps, and this series must be maintained. Happily the Indian Government have not hesitated to undertake also the sheets of the International Map falling within its sphere; and they are to be congratulated on this important resolution.

The Bombay sheet under notice was engraved in accordance with the characteristic sheet of the London Conference, 1909; but the scale of layer colours has been changed to accord with the intentions of the Paris Conference of 1913, whose report is not yet published. "It is the first engraved sheet printed at Calcutta in colours from separate colour plates, a process which in the climate of Bengal presents certain difficulties not met with to the same extent in Europe." The result requires no apologies. It is an excellent specimen of clean-colour printing, of a region which does not lend itself to a pretty result: a high plateau falling steeply to the sea.

Contours are drawn at 100, 200, 300, 400, 500, 600, 800, 1000, 1200, 1500 metres; but the layer tints are not changed at 800 and 1200. The gauge of lettering for the lowest class of towns, which is left to discretion, is perhaps rather small for legibility; and the sign for ports with regular mail communication is used somewhat freely: it may be doubted whether local mail services need be shown with this rather heavy sign. These are small points of interpretation in which there is divergence of practice. In general the Bombay sheet conforms as closely as may be to a scheme which was undergoing revision while the engraving of the map was in progress. Further sheets of this most valuable series will be awaited with interest: in particular the sheets covering the area of the map on a smaller scale noticed above.

THE MACCLESFIELD DISTRICT.*

II. VEGETATION.

By Miss LILIAN BAKER.

On the distribution of the Vacciniaceæ :—

I. *Vaccinium myrtillus*, as has been already mentioned, appears above the 500-feet contour at the south end of Congleton Edge, coming slightly below it at the northern end distant about 3 miles. In Tidnock wood it occurs at 400 feet and reaches a length of 3 feet in the shady parts.

II. *Vaccinium vitis-idæa* occupies the dry parts, especially the steep escarpments of the Cloud hill, the northern slope of Congleton Edge and the banks along the sides of lanes in the Macclesfield district. It is present with *V. Oxycoccus* in the intermediate situation mentioned below. Of *Empetrum nigrum*, de Tabley says, "Of course on the highlands of East Cheshire *Empetrum* is common enough, beginning to show in force at about 1000 feet, but its comital distribution seems worth tracing minutely. We have it on the low-lying mosses (not on the sheet, but further north). . . . The presence of *Empetrum* and former presence of *Saxifraga Hirculus* at Knutsford (4 miles north-west of Chelford), point to one fact: they are both relics of a much older flora, when perhaps continuous mosses connected the now highly cultivated plain of Cheshire with the hilly districts of the east."

III. *Oxycoccus quadripetala* is said by de Tabley to have been plentiful in the neighbourhood of Congleton formerly, but drainage of this, presumably Mossley Moss and other mosses has made it scarce. It is plentiful in the *Sphagnum* swamps of Brookhouse and Dane's Mosses, and occurs half a mile north of Mossley Moss in a *Juncus* association lying at the junction of the third grit and shale, at an altitude of 700 feet, and with no appreciable thickness of peat. It thus appears here in a situation intermediate between those of lowland mosses and elevated moorlands, assigned to it by de Tabley.

IV. *Freshwater Aquatic Formation.*

(1) Waters rich in mineral salts are found in the meres, clay pits, canals, and their feeders. The meres, though less frequent than in former times, are still a characteristic and pleasing feature of the Cheshire plain. The larger ones occur in the northern and eastern portions, the south-western part having innumerable small ones, the monotony of this flatter portion being pleasantly interrupted by "pits," fringed with reed-mace and bur-reed, and inhabited by water-hens, wagtails, and others of a varied and interesting fauna.

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* Continued from p. 228. The numbers in brackets refer to the Bibliography at the end of the paper.

The largest pieces of open water are Rudyard lake, Bosley reservoir, and Knypersley pool, which are largely artificial, and also Redesmere and the pools at Astle, Capesthorne, North Rode, Winterley, and Rode Heath.

The following aquatic plants are found more or less submerged.

Meres and pits:—

Ranunculus circinatus
" *peltatus*
" *heterophyllus*
" *hederaceus*
" *sceleratus*
" *lingua*
Caltha palustris
Nymphæa lutea
Castalia alba
Polygonum amphibium
Ceratophyllum demersum
Myriophyllum spicatum
" *alterniflorum*
Zannichellia palustris
Iris pseudacorus
Alisma plantago-aquatica
Stratiotes aloides
Elodea canadensis
Phragmites communis
Carex ampullacea
Hippuris vulgaris
Callitriche stagnalis
Typha latifolia
Sparganium erectum
" *simplex*
" *minimum*
Lemna trisulca
" *minor*
Potamogeton natans, lucens
" *crispus*
" *perfoliatus*
" *obtusifolius*
" *pusillus*
" *polygonifolius*
" *pectinatus*
Scirpus palustris
" *fluitans*
Carex paniculata
" *vulpina*
" *vesicaria.*

From the canals the following additions to this list may be noted:

Ranunculus fluitans
Potamogeton perfoliatus
Sagittaria sagittifolia
Alisma ranunculoides
Butomus umbellatus
Glyceria fluitans
" *aquatica*

(2) Water poor in mineral salts occurs in the trenches in peat, and supports the following species:—

Ranunculus Lenormandi
Caltha palustris
Typha latifolia
Montia fontana
Hypericum elodes
Apium inundatum
Utricularia vulgaris
" *minor*
Potentilla palustris
Menyanthes trifoliata
Galium palustre
" *uliginosum*
Hydrocotyle vulgaris
Myosotis palustris
Sparganium erectum
Alisma plantago-aquatica
Carex inflata
" *remota*
" *leporina*

(3) Quickly flowing streams of the non-calcareous type occur among the hills, though the slope of the plain is such that the longest streams, *e.g.* Dane and Wheelock, are still fairly rapid as they leave the district.

The following species occur in such constantly moving water :—

Ranunculus Lenormandi
Montia fontana
Epilobium palustre
Stellaria uliginosa
Veronica Beccabunga
Sparganium erectum.

V. Marsh Formation.

(*a*) Alder-Willow associations have been considered under the heading of Woodlands.

(*b*) Herbaceous marsh occurs, as has been stated before, as a marginal association for the meres, clay pits, and canals, and as a transitional state in the drying up of a mere.

Sufficient alkalinity is not developed nor is the mineral content high enough for a true fen-formation to arise; but where aeration is fairly good the peat bog state is avoided and the resulting vegetation must be classed as herbaceous marsh.

The following plants are found in these marginal associations :—

Ranunculus lingua
" *repens*
" *ficaria*
Caltha palustris
Cardamine amara
" *pratensis*
Barbarea vulgaris
Radicula Nasturtium-aquaticum
Viola palustris
Lychnis dioica
Stellaria aquatica
" *uliginosa*
Lythrum salicaria
Epilobium angustifolium
" *hirsutum*
" *parviflorum*
" *roseum*
" *tetragonum*
" *obscurum*
" *palustre*
Hydrocotyle vulgaris
Cicuta virosa
Bidens cernua
" *tripartita*
Scrophularia aquatica
" *nodosa*
Veronica scutellata
" *Anagallis*
" *Beccabunga*
Lycopus europæus
Mentha piperita
" *hirsuta*
" *sativa*
Myosotis palustris
Lysimachia vulgaris
" *nemorum*
Rumex conglomeratus
" *hydrolapathum*
Polygonum hydropiper
" *minus*
" *bistorta*
Polygonum aviculare
Iris pseudacorus
Juncus effusus
" *bufonius*
" *articulatus*
Stachys palustris
Anagallis tenella
Senecio aquaticus
Chrysosplenium oppositifolium
Saxifraga granulata
Valeriana sambucifolia

Alopecurus geniculatus
Spiræa ulmaria
Peplis portula
Eupatorium cann abinum
Petasites ovatus
Œnanthe fistulosa
„ *phellandria*
Angelica sylvestris
Scutellaria galericulata
„ *minor*
Ajuga reptans
Gentiana pneumonanthe
Hypericum elodes

Lowland Moors.—The lowland moor is the only type of moorland represented in the district.

All old records of Cheshire make mention of the "spacious heaths and commons that lie everywhere dispersed," and it is probable that many parts unmentioned in the Domesday Book were unreclaimed moors: *e.g.* Moreton, which has moorland near it, on the west side of Mow Cop. The heaths were "a good help for the poorer sort. Out of the mosses they dig turves every summer, every man as shall serve his turn, to burn all the year. Which turves in some places when they are dry, are reddish and soft, much like a sponge, which burneth fast away and giveth not so good a light or heat as the other sort, which are black and very hard when they be dried, and are much better than the other. Moreover, in these mosses (especially in the black), are fir-trees, found under the ground (a thing marvellous!) in some places 6 feet deep or more, and in some places not one foot: which trees are of a marvellous length and straight, having certain small branches, like boughes, and roots at one end, like as if they had been blown down with weather; and yet no man can tell that ever any such trees did grow there; nor yet how they should come thither. Some hold opinion that they have lain there ever since Noah's Flood." From Dane's Moss near Macclesfield 10 to 15 feet of peat are said (5) to have been removed, and remains of fir, oak, beech and other trees have been recorded as found in it, but workmen now engaged on it deny their presence. Several of these mosses present a type of Lowland Moor comparable with those described by W. M. Rankin (10) in Lonsdale, and all stages of transition noted by him occur on different mosses, and in some cases, on the same moss. Drainage and cultivation have interfered with the natural process of evolution to such an extent in certain cases, that the name of the place and the dark colour of the soil are the only records of the original state. Hence the distribution of peat on the geological map is no guide to that of the lowland moors.

Dane's Moss, above mentioned, consists almost exclusively of *Sphagnum* peat except for a thin superficial layer of roots of *Eriophorum*, *Calluna*, etc. The dominant species are *Eriophorum vaginatum* and *angustifolium*. Sub-dominant is *Calluna vulgaris*, with *Erica tetralix*, *Deschampsia flexuosa*,

Juncus squarrosus. The damper portions contain *Oxycoccus quadripetala*, *Drosera rotundifolia*, *Andromeda polifolia*, etc.

Birch and willow occur on the western portion abutting on the sand; they are almost absent on the eastern portion near the clay which here limits the moss.

Brookhouse Moss represents more stages in the life of a lowland moor, the following being noticeable:—

(1) Swamp with *Typha latifolia*, south of the Brookhouse Green lane.

(2) Swamp with *Alnus glutinosa*, *Salix spp.*, *Spiræa ulmaria*. This swamp is edged with *Polygonum amphibium* and *P. Hydropiper*, *Juncus bufonius*, *Gnaphaliun uliginosum*, *Achillea ptarmica*; a similar association sprang up in the parts of the bed of Rudyard lake which dried up in the summer of 1911. The soil here is black and decomposed.

(3) Sphagnum swamp occurs in several places, and may be covered with *Eriophorum angustifolium*, *Oxycoccus quadripetala*, *Andromeda polifolia*, *Drosera rotundifolia*, *Narthecium ossifragum*, *Juncus conglomeratus*, *J. articulatus*, *Potentilla palustris*, *Calluna vulgaris*, *Erica tetralix*, *Epilobium tetragonum*, *Rumex crispus*, *Orchis incarnata*.

(4) Drier edge of small birch, still among sodden sphagnum but leading to firm ground with thick growth of *Betula tomentosa*.

(5) Tussock formation of *Molinia cærulea*, in many parts quite pure, even though it is dry and surrounded by birch trees or rough ground, which suggests a tussock origin.

(6) Extensive birch wood, *Betuletum tomentosæ*, unplanted and except at the outer edge free from oak. The trees are so close that there is practically no undergrowth.

(7) For trenches see section "Aquatic Associations."

A swamp similar in character to (1) above occurs in the undrained portion of Bagmere, and represents the last trace of an extensive lake. Another moss showing an alder swamp is Glead's Moss, which is, however, purely alluvial in composition, though the water is acid to litmus. Alder is here distinctly dominant, but is accompanied by *Pyrus aucuparia*, *Corylus avellana*, *Salix spp.*, *Equisetum palustre*. The alder is rooted in tussocks of *Molinia cærulea*, and the other trees and shrubs appear to have sprung up on the islands so formed. The drier portions develop birch, heather, and the common constituents of a birch-heath flora. Such is the wild and tangled nature of this "moss" that it is locally known as "No Man's Land." The sphagnum swamp stage occurs in larger or smaller areas on all the mosses which are still in the damp stage, notably and extensively on Dane's Moss, and also on smaller areas held up on the side of Congleton Edge. These last contain *Eriophorum angustifolium*, *Oxycoccus quadripetala*, *Erica tetralix*. Their history will be discussed later.

The tussock formation with *Molinia cærulea* is seen in an interesting transitional form to the south of Tidnock wood, where the sphagnum is

dotted with tussocks of *Molinia*, *Juncus effusus*, *Eriophorum vaginatum*, with a few small birch trees. It is, however, being filled up by sand washed in by rain from a sand mound on its northern side, and is being colonized by *Pteris aquilina*, which is dominant on the sandy slope. The rest of the wood is an oak-birch heath planted with *Larix europæa* and *Pinus silvestris* developed on the drained peat and on the sandy edges. In the well-drained parts *Calluna vulgaris* occurs, also *Vaccinium myrtillus* reaching a height of 3 feet, *i.e.* the shade type. *Holcus mollis* is common and *Pteris aquilina* quickly appears in the clearings. In an adjacent wood, on sand, *Molinia* tussocks occur with *Rubus fruticosus* and *Holcus mollis* between.

A more advanced state of wood on peat is seen on Cock's Moss which is well drained and carefully planted with *Pinus sylvestris*, the undergrowth being killed by shade and pine needles. This may be said to represent the extreme case of wood development, as opposed to the swamp from which it originated.

The present plant covering of the mosses and meres supports the view, taken primarily by the geologists, that the eastern portion of the map is the site of, perhaps, five large lakes formed in glacial times and held up at first by the retreating ice, later by moraines and glacial mounds. This effect of the Irish sea ice is proved by the presence of marine and lacustrine deposits in these areas, and this view offers a reasonable explanation of the present vegetation. Evidence of the comparatively recent disappearance of these lakes is found in various authors, *e.g.* King (8), in 'The Vale Royal of England,' mentions "Oakhanger mear from whence begins that water which afterwards gets the name of Fullbrook till it meets with Wheelock," now represented by Oakhanger Moss. Also "Bagmere, being very large and deep, and from it runs a water, Croco, which quickly hastens to increase the Dane." It is now a small pool, the haunt of snipe and herons, edged with *Typha latifolia*, *Carex spp.*, *Juncus spp.*, and surrounded, outside a ring of alder wood, by a basin-like depression showing *Junceta* in the lower portions, *Molinieta* towards the edge, and elsewhere mixed meadow grasses merging into oatfields. The river Croco now flows along nearly half a mile west of the present Bagmere, and rises near Brookhouse Moss, a mile and a half further south. This suggests that the mere and the moss were formerly continuous and part of an older larger lake or mere system, which is responsible for the peat at Spen Moss, Martin's Moss, and Blakemoor. These last three are only now recognizable by the dark colour of the earth, as they have long been reclaimed and cultivated.

Another fact in favour of the lake sites is that pointed out by B. W. Baker, that the main north-south roads, and especially the older and the Roman roads, are carried along the ridges which separate them. On comparing the sketch-maps of these lake sites, which have been drawn from the geological map, according to the outlines suggested in the Geological

and Geographical Memoirs, with the description of their vegetation given in the text, it will be at once obvious that those mosses which have been most easily drained and exploited are those found in the sites which have a vague northward extension. Dane's Moss lake site was probably open as far as the Mersey. On the other hand Lake 5 was enclosed to a much later period, its last untouched hollow being represented by Brookhouse Moss.

It will be further seen that the natural state of a moss, as well as the possibilities of artificial drainage, have been greatly influenced by the natural drainage due to streams which have, since the disappearance of the lakes, cut back, in many cases, till they have crossed the original lake boundaries, *e.g.* Ben brook rises south of Lake 1 area, unites with Gandy's brook and flows through Lakes 3 and 4. The northern part of Lake 4 has a succession of beds of river gravels which may be responsible for the rapid drainage of that part, leaving the peat hollows of the southern part to be drained later by transverse streams.

It must not be thought that these areas represent entire lake surfaces. Probably at no time did even five large lakes exist together. The presence of lacustrine deposits, laminated clays, etc. (see 'Geological Memoir'), together with evidences of marine deposits, has led to the theory of the fen-like character of the district in immediately post-glacial times. The lines of morainic material and silt suggest that the cutting off of these fens from the sea was as much a result of alluvial accumulation as of any rise of the land surface. Such a theory of the development of the district offers a reasonable explanation of the history of the vegetation, and is in accordance with the views of Danish botanists with regard to similar districts in Denmark.

Culture Associations (24).

Comparison of statistics and graphs relating to climate shows that whilst the Plain region has a rainfall below 32 inches per annum, and the Hill region a rainfall above that limit, both regions have mean July temperature above 13° C. These limits, *i.e.* 32 inches of rain and a July temperature of 13° C., have been proposed by Smith and Moss (21) as those of the regular wheat crop on the eastern side of the Pennines, *i.e.* West Yorkshire. The delimitation of the wheat and oat growing areas in the Cheshire district is complicated by the fact that the Plain region is one of heavy clays, too heavy for wheat, but suitable for meadow grasses, and, therefore, for cattle and dairying, and the Hill region has too high a rainfall and too poor and thin a soil covering. The district may, therefore, be regarded from an economic point of view as one of grasslands, suitable for oats and for root crops.

The upland farms are now largely given up to sheep and cattle rearing, but the nearness of industrial centres, the excellence of the roads, and the

industry of the farmers are shown in the height to which cultivation has been pushed. Although the summits may be classified as grass-heath there is plenty of evidence that the majority of the fields have been ploughed at some time, and the wildest heaths have been drained, burnt or cropped. Rushes and bracken are harvested by the farmers, the ancient ceremony of rush-bearing being still maintained in the Macclesfield forest district.

Orchards are numerous but small, the total acreage for Cheshire and Staffordshire being as follows :—

	Cheshire.	Staffordshire.
Apples	988 acres	552 acres
Pears	261 „	63 „
Cherries	50 „	29 „
Plums	62 „	50 „
Small fruit	213 „	54 „
Others	511 „	441 „
Total under fruit ...	2085 „	1189 „

Cereals are represented by oats, wheat, and barley, but, owing to the heavy rainfall and heavy clay soils, are exceeded in importance by the pasture land. Oats form the principal crop and give a good yield. This crop is found in scattered patches up to the 1000-foot contour line and rarely above, in sheltered valleys. It occurs up to 1000 feet on the western side of the Bosley Cloud ridge more frequently than on the eastern side. This fact, together with that of the subordination of wheat, makes the scanty records of rainfall and local temperatures regrettable. The whole district is undoubtedly an oat-producing area. Wheat is seldom sown above 500 feet, oats and root crops being preferred. Barley is so largely produced in Staffordshire that its cultivation in Cheshire is limited to a comparatively small area.

Potatoes, turnips, and swedes are found in many exposed upland positions, but give a good yield. Hay and pasture land occupy the largest part of the cultivated land. The excellence of the pasture is attributed generally to the rainfall, which after the March maximum remains moderate and evenly distributed till June or early July, when the hay may be cut. The August maximum helps to bring on the aftermath, the harvesting of which is favoured by a drier September.

The following table from the *Agricultural Report* for Cheshire represents the state of cultivation.

King (8), in referring to the enclosed ground, observes: "the third part thereof is reserved only for tillage, which bringeth forth corn in great quantity; . . . especially wheat and rye, also oats and barley, beans, peas, fitches, French wheat, and such like."

Cheshire.	Total produce, 1910.	Acreage.	Yield per acre.	Average, 1900-1909.
Wheat	59,173	14,195	31·66	32·25
Barley	4,662	1,162	32·10	30·70
Oats	282,416	65,641	34·42	35·55
Beans	493	145	27·19	27·37
Peas	416	126	26·41	29·62
Potatoes	130,645	20,778	6·29	6·10
Turnips and swedes ...	202,554	10,437	19·41	17·23
Hay from clover	103,105	57,431	35·91	36·93
Clover hay from sown grass	130,498	98,111	26·60	25·47

Hedgerows, Roadsides, and other Unstable or New Habitats.

The uniformity of composition of the vegetation of the district, *i.e.* a general tendency to the development of grass-heath, leads to the question of the methods by which the individual species have spread, and a study of the district has suggested that this is not due so much to the action of wind, water, and the other accredited agents acting over the isolating spaces, but to definite interference lines across those spaces. The relations of hedgerow, roadside and stream-bank vegetation to that of the surrounding country present interesting problems, for these habitats may possess the relics of the original flora, or, on the other hand, may bear the most recent of immigrants, "weeds;" though it should here be noted that the term "weed" needs definition. If a "weed" is a plant occurring out of its natural association, the class will have to be considerably enlarged and the application of the term extended. If, however, it be simply regarded as a wild plant which occurs, as it were, spontaneously in a culture association, then the hedgerows of a cultivated area may be expected to be the habitat, *par excellence*, of weeds and a new association has constituted itself. Such an "association" occurs on the roadsides and by-lanes round Macclesfield, and in the more carefully cultivated parts of Cheshire, wherever the roadsides are often remade. It is especially frequent in the clay regions and may be classified as the cultivation type of hedgerow.

It contains:—*Ranunculus acris*
,, *repens*
Vicia sativa
Lathyrus pratensis
Polygonum persicaria
,, *hydropiper*
,, *aviculare*
Capsella bursa-pastoris
Cardamine pratensis
,, *amara*
Trifolium pratense
,, *medium*
Chenopodium album
Chelidonium majus
Bellis perennis
Lotus corniculatus
Galium saxatile
Poa spp.

The heath type of hedgerow undoubtedly represents the remnants,

after enclosure and cultivation, of the heathlands, and offers a marked contrast with the above type.

It contains :—*Rosa canina*, *Prunus spinosa*, *Rubus spp.*, *Lotus corniculatus*, *Cytisus scoparius*, *Ulex europæus*, *Potentilla erecta*, *Centaurea nigra*, *Solidago virg-aurea*, *Geum urbanum*, *Teucrium scorodonia*, *Digitalis purpurea*, *Juncus effusus*, *Campanula rotundifolia*, *Rumex acetosella*, *Calluna vulgaris*, *Erica tetralix*, ,, *cinerea*, *Galium saxatile*, *Achillea ptarmica*, ,, *millefolium*, *Pteris aquilina*, *Holcus mollis*, ,, *lanatus*, *Festuca ovina*, *Deschampsia flexuosa*

This heath type occurs extensively on the Plain and is responsible for the beauty of the numerous side roads and lanes which twist pleasantly about among the fields and woods, often with wide grassy borders and high sandy banks, the haunt of rabbits and pheasants. It is the prevalent type in the uplands above 500 feet. An excellent example is seen in the lane leading from Mow Cop station to the summit, a rise of over 500 feet, from the agricultural district on clay to the Millstone Grit, with grass and *Calluna* heath, which caps the summit.

The Stream-side Association resembles that of the ground of a damp oak wood so strongly in places as to suggest that that may have been the original vegetation of the valley, *i.e.* the oaks have been cut down or removed in the natural course of the denudation of the valley slopes. Where the valley runs fairly high into the hills it is reasonable to expect the ground flora to extend higher than the oaks themselves, which, on an unstable valley side, could hardly retain their hold, owing to the rush of winds through the valley. In this way the plants of the damp oak woods and the clay soils penetrate far into the region of grass heath, just as, on the other hand, by means of sandy hedgerows, the heath plants enter the cultivation region.

The following list was obtained from the river Trent at a height of about 700 feet :—

Cardamine hirsuta, *Lychnis dioica*, *Senecio aquaticus*, *Teucrium scorodonia*, *Veronica montana*, *Deschampsia cæspitosa*, *Deschampsia flexuosa*, *Anthoxanthum odoratum*, *Geranium Robertianum*, *Spiræa ulmaria*, *Prunella vulgaris*, *Ajuga reptans*, *Valeriana officinalis*, *Holcus lanatus*, *Bromus sterilis*, *Dactylis glomerata*

This list is comparable in character with that given for damp oak woods, and resembles closely one taken from near Illidge green, *i.e.* occurring on clay.

The Margins of Clay Pits present a refuge for species driven from the surrounding cultivated regions. Those which are completely isolated often preserve unique species, but their vegetation is not so varied in character nor so closely related to that of the district round the field as is that of ponds which lie near the hedgerows or near a pathway crossing a field. The typical marginal association has been treated of in the section on marsh associations.

Shale Slopes.—A further instance of the colonizing power of the heath association, or its persistence as a transitory phase in the continuous changing of the vegetation of a district, is its presence on the steep shaley slopes which do not offer a stable foothold for any plants. The habitat resembles a scree on a small scale. Observations of such situations, *e.g.* near Walker barn, east of Macclesfield, have shown that after a severe storm a whole slope may be denuded of its plant covering. The first to reappear is *Deschampsia flexuosa*, followed by *Calluna vulgaris*, *Anthoxanthum odoratum*, *Campanula rotundifolia* and *Hieracium umbellatum*. The process is a slow one, but that it is not extraordinary is shown by examination of similar stations in North Staffordshire, south-east of the district, where it is more frequent owing to the presence of shale heaps around coal-mines where continually renewed surfaces of mine refuse are exposed. There, however, the ericaceous colonists are rarer, since the surrounding heath land is of the pasture type, *i.e.* chiefly *Deschampsia flexuosa*. No instance of new railway cutting or embankments has been noted and the existing ones do not offer any special points of interest. Canal cuttings and feeders have been treated of in the aquatic section.

General Considerations.—A study of the plant distribution in any limited area such as that described above leads inevitably to the recognition of three important affective factors: I. land forms; II. soil conditions, and III. man.

I. The influence of land forms may be said to be of two kinds: (*a*) direct and (*b*) indirect. By direct would be understood the influences of altitude and slope and their interactions; by indirect, that of climate due to variations in rainfall, temperature, wind or induced by the land forms.

(*a*) The direct effect of surface features on vegetation is seen in the fact that altitudinal limits are assigned to different plants, *e.g.* on Bosley Cloud the lower limit of *Vaccinium vitis-idæa* is 900 feet. These limits vary with the height of the land mass in question, *e.g.* in the Northern Pennines the limit of this plant would be much higher.

With altitude, exposure to wind and sun increases, inducing conditions which can only be endured by xerophytic plants adapted to resist them. The effect of slope is seen in the inability of some plants, especially some

trees, to retain their hold on the thin soil of a steep slope; only those which have a spreading root system can live in such places, *e.g.* birch, beech. Again, slope involves drainage and the amount of water present; it therefore determines the presence of plants adapted to the conditions produced, *e.g.* hydrophytes in the stream or pond-filled hollows, lichens on the vertical rock faces. With drainage is associated the aeration of the soil, hence its acidity and the possibility of peat formation. This is seen in the presence of lowland moors in the hollows of the Plain and the absence of moorland on the steep faces of the ridges.

With the slope there is proportional variation in the aeration of the water itself, so that the series from rapidly moving waters with high oxygen content to stagnant waters with low corresponds to a series of plant associations suited to these conditions.

(*b*) The indirect effect of land forms due to their influence on climate is exemplified by the presence of xerophytic plants east of Macclesfield in the region of snowfall, and the possibility of better cereal crops at Wincle owing to the decreased rainfall of this sheltered hill locality. It is also concerned in the difference between the vegetation of eastward and westward slopes, though in this district the effect is slight. On a larger scale it is seen in the heavier rainfall of the hill region and the general humidity of the Plain, with the consequent development on the latter of rich meadow land.

The sheltering effect of high land together with the exposure to insolation makes possible the growing of oats in certain isolated highland areas, *e.g.* under the ridge of Bosley Cloud above Timbersbrook and between Macclesfield and Walkerbarn.

The effect of wind on peat in upland areas has been mentioned, and is better exemplified on the still higher parts of the Peak District. It is further seen in the confinement of trees to sheltered valleys in the hills. For whereas on the Plain, *e.g.* oaks occur along the streams and in the hedgerows, on the hills they seem to be unable to obtain or retain sufficient moisture for their life processes apart from the erosion valleys, which are effectively marked out on the map by the presence of trees.

Direction of rain, wind, and the sun's rays all vary with the slope and have more or less effect on the plant covering, *e.g.* as denuding or desiccating agents.

II. The influence of geology on vegetation. This acts mainly in three ways, *i.e.* through the stability, porosity, and chemical composition of the soil and underlying rocks.

Examples have been given of the effect of stability of surface on the vegetative covering, and of the differences in the powers possessed by plants of colonizing unstable surfaces. Not only do the physical and chemical characters of the soil or rock cause variation in stability, but the slope of the ground is a potent factor. Hence the sands of the plain may furnish a more stable habitat than the rocks of the hills.

Porosity of soil is not necessarily dependent on that of the underlying rock since there may not be free passage from the one to the other. In sandy areas an impervious layer is often formed by the interaction of the sand with humous compounds, in which case accumulation of water or peat may be more rapid than it is in the adjacent clay hollows. Where there is direct connection the greater porosity of grit as compared with crowstone might be expected to have effect. To decide this would require long and detailed investigation especially of the lower forms of plant life in both situations. The chemical composition of the rocks has little effect, since the calcareous shales and nodules in the shales have not a sufficiently high percentage of lime to induce any noticeable effect on the vegetation. A cement of lime is often present in millstone grits, also phosphates, but their action appears to be negligible.

III. *Influence of Man.*—From what has been said as to the former prevalence of mere, marsh, and woodland on the Plain it appears probable that the earliest interference of man with this region was for purposes of traffic.

Road-making entailed the clearing of timber, the opening of some drainage channels and the blocking of others. On the hills the presence of ruined crosses, *e.g.* at Clulow and High moor, "Cromlechs," *e.g.* the Bridestones and Wickenstones and east of Macclesfield, "Roman" roads, suggests that the hills may not have been so impassable and that the moorlands of these parts were not the sodden peat bogs which must have occurred further north, nor were the "forests" anything but open grass moors. Judging from the luxuriant tree growth of the Plain at present and the extensive use of timber even in recent times in building, this region may have undergone considerable clearing.

With road-making and building would inevitably come new plants, alien invaders, either brought accidentally by man, or migrants more suited to the new conditions and altered localities than any of the indigenous plants. The most persistent of man's followers at the present seems to be the nettle, *Urtica dioica*, which appears where road-sweepings are dumped or even where an old wall is mended.

Peat-cutting has certainly been extensive and has resulted in the complete removal of the peat, and hence the disappearance of the associated plants, from many localities. Even in Brookhouse Moss, the most nearly natural of all the mosses dealt with, artificial drainage has hastened processes which would naturally have taken many centuries to accomplish. The black soil left, marking the site of old "mosses," has the great disadvantage that it usually occurs in places where the surface features encourage the accumulation of water, hence to obtain the best results from agriculture it requires very careful treatment as to drainage and aerating.

Generally speaking, cultivation has introduced meadow grasses and associated plants, and these have found the conditions on the Plain so

congenial that they have driven the original inhabitants to hedgerows, roadsides and, in some cases, the hills. That this process has not been uniformly continuous is proved by the greater production of cereals last century. These would be accompanied by a different set of weeds from those now prevalent, and many of these have survived the replacement of their former protectors.

Enclosure of heaths, improved forestry methods, the establishment and maintenance of parks, preservation of large areas for game, have resulted on the Plain in "taming" the vegetation and giving the country that appearance of orderliness and prosperity which characterizes it. Whether it has revenged itself on man and is responsible for the reputed combination of dulness and strength of the Cheshire-born is another question.

Summary.

The district is one in which the meeting and inter-connection between the lowland agriculture and the upland pasturage is well exemplified. As a vegetation region it is not only highly unnatural as to limits but also contains mere traces of the original types of plant covering.

The greatest change which has affected this district within recent times is that in amount of soil water, since it has been shown that large areas have been recovered from bogs and river marshes by drainage. In other parts, especially the highlands, the deforestation has led to partial drying of the soil and may account for its present shallowness on the steeper slopes where tradition locates plentiful woodland.

The dominant type of vegetation is the grass heath and is the result of the retrogression of the moorlands, the deforestation of the lower hill slopes, the draining and grazing of marshy ground, *i.e.* it represents a transitional stage in the history of the vegetation or a temporary equilibrium between the various factors which are at work upon the area.

The characteristic vegetation of the dry parts in former times, before artificial drainage, *i.e.* the vegetation of moraines of sand and gravel, of old river-beds of similar soil structure, and of the bleak treeless hillocks was of a heath-type with ericaceous plants dominant.

As the adjacent lowlands were drained plants of this heath type spread over till checked by undrained portions, rivers, or cultivation. Into these by means of road and stream sides, at first, and later by hedgerows, the hardier species would penetrate, and finally through-passages would be established to suitable stations of similar type scattered about the lowlands. Such plants would be suited to the conditions which precede the establishment of the stable woodland formation as well as to those which follow deforestation, and in many parts these two phases appear inextricably mixed. In all these heath associations the transitions are so gradual that it is difficult to delimit any one of them; but though by human interference the *Calluna* heath is being transformed into grass

heath and the area of the latter is increasing, that of the former is also increasing. It is recruited from "mosses" by drainage, a type of ericaceous vegetation being developed which is, even with a thick substratum of peat, very similar to the grass heath formed by the retrogression of the moorlands.

BIBLIOGRAPHY.

1. Barber and Ditchfield (ed.), 'Memorials of Old Cheshire.' 1910
2. Harrison, 'Cheshire Parks and Deer Forests.' 1903.
3. Ormerod, 'History of Cheshire.' 1882.
4. Earwaker, J. P., 'East Cheshire.' 1877.
5. Pocock, T. J. (ed.), Geological Memoir on sheet 110. 1906.
6. *British Rainfall.*
7. Buchan (ed.), Bartholomew's Meteorological Atlas.
8. King, 'The Vale Royal of England.' 1656.
9. Moss, C. E., "The Fundamental Units of Vegetation," *New Phytologist.* 1910
10. Rankin, W. M., 'Types of British Vegetation,' pp. 247–254. 1911.
11. Graebner, P., 'Die Heide Norddeutschlands.' 1901.
12. Lewis, F. J., "Geographical Distribution of Vegetation of the Basins of the rivers Eden, Tees, Wear, and Tyne," *Geog. Journal.* 1904.
13. Moss, C. E., (*a*) "Peat Moors of the Pennines," *Geog. Journal.* 1904.
———, (*b*) 'Vegetation of the Siliceous Soils (Types).' 1911.
14. Hardy, M., 'Esquisse de la Géographie et de la Végétation des Highlands d'Écosse.' 1904.
15. Warming, E., 'Okologischen Pflanzengeographie.' 1896.
16. Drude, O., 'Der Hercynische Floren Bezirk.' 1902.
17. Moss, Rankin, and Tansley, "Woodlands of England," *New Phytologist.* 1910.
18. Massart, J., 'Essai de Géographie Botanique des Districts Littoraux et Alluviaux de la Belgique—Bruxelles.' 1910.
19. Moss, C. E., "British Oaks," *Jour. of Bot.*, 48.
20. De Tabley, W., 'Flora of Cheshire.' 1899.
21. Smith and Moss, "Geographical Distribution of Vegetation in Yorkshire," *Geog. Journ.* 1903.
22. Tansley, A. G., 'Types of British Vegetation.' Cambridge, 1911.
23. Crampton, C. B., "The Geological Relations of Stable and Migratory Plant Formations," *Scot. Bot. Rev.* 1912.
24. Board of Agriculture and Fisheries, Annual Reports.
25. Moss, C. E., 'Vegetation of the Peak District.' Cambridge, 1913.

REVIEWS.

EUROPE.

Geographical Studies in Baden.

(1) 'Die Oberflächengestaltung des nördlichen Schwarzwalds.' By Dr. Heinrich Schmitthenner. (Abhandl. zur Badischen Landeskunde, 2 Heft.) Karlsruhe: G. Braun. 1913. 3 *M.*

The northern Schwarzwald consists of a basement of granitic and early Palæozoic rocks originally covered with a continuous sheet of Mesozoic sandstone

(Buntsandstein), resting upon a Permo-Carboniferous peneplain. The sandstone now occurs as detached plateau-like masses rising above the river valleys which trench both the sandstones and the granites. The old peneplain frequently appears as a more or less dissected terrace or platform between the steep sandstone walls of the relic plateaus and the rounded granitic slopes which lead down to the present rivers. The author devotes much space to a consideration of the processes responsible for the uncovering of the ancient peneplain, and concludes that the predominant process has been spring erosion acting mainly along the junction of permeable and impermeable beds. The platforms which vary in elevation are therefore denudation terraces as distinguished from terraces of stream erosion, and the escarpments of these plateaus are the oldest and the most westerly in the scarplands of the Neckar and the Maine. The existing valleys are partly consequent and partly subsequent, and afford evidence of rejuvenation during Tertiary times and of glacier action in their upper reaches during the Ice Age. Corries occur mostly in the sandstone between 580 metres and 1050 metres with a prevailing north-easterly exposure. They are believed to be original spring and stream hollows in the sandstone escarpments, enlarged and modified by frost and glacier action. The monograph is of considerable interest, but might profitably have been much condensed.

(2) 'Studien zur Talgeschichte der Grossen Wiese im Schwarzwald.' By Dr. Bernhardt Brandt. (The same, 3 Heft.) Karlsruhe: G. Braun. 1914.

In this well-written monograph Dr. Brandt traces the influence of tectonic movements upon the evolution of the valley of the Grosse Wiese. Infolds of Carboniferous rocks occur within the crystalline basement of the southern Schwarzwald, the fold lines being accompanied by fracture lines trending N.W. to S.E., W. to E., and N. to S. The region was reduced to a peneplain during Permo-Triassic times, covered with Jurassic accumulations, re-elevated, and exposed to denudation. The sedimentary sheet had been removed by early Tertiary times, and the original consequent streams cutting into the crystalline basement were in many cases diverted along the earlier lines of weakness. During Pliocene times a renewal of crustal movement led to the formation by fracture and subsidence of a number of lake basins along the course of the river, which were further enlarged during the Ice Age. The cutting of the bars and the draining of the lakes gave rise to the alternation of wide and narrow reaches which is characteristic of the present valley. Various sketch-maps showing the distribution of fault and fracture lines with reference to the present course of the river and its tributaries accompany the monograph and deserve careful study. If the demonstrations of the various points are correct, they will lend some support to the suggested hypothesis of the faulted origin of the British valley lakes. J. D. F.

ASIA.

Paphlagonia.

'Paphlagonia. Reisen und Forschungen in Nördlichen Kleinasien.' Von R. Leonhard. Pp. xiv., 401. *Illustrations and Maps.* Berlin: Dietrich Reimer. 1915. 23*s.* 4*d.*

This book gives detailed accounts of three journeys undertaken in 1899, 1900, and 1903 by the Breslau professor, Dr. Richard Leonhard, not only in ancient Paphlagonia, but also in Eastern Bithynia, Galatia, and western Pontus. Starting from Angora in the first instance, he visited pretty nearly all the principal centres of population in its *Sänjak*, and also in the *vilayet* of Kastamuni

to the north. His extreme points, west and east, were the lower Sakaria Valley and Boiabad. This embraces an ill-defined region for which there is no inclusive special name nowadays. It has been very little explored in its central parts, which are mostly mountainous, though without very high peaks or very pronounced ranges, and are rather bare and uninteresting except on the Black Sea slopes. Colonel Mark Sykes is, we believe, the last Englishman who has made any study of it, and he had very few predecessors. No part of it has fallen within Sir William Ramsay's purview, and as a whole it remains about as ill-known and remote now as it was in the time of the Romans. Prof. Leonhard, who travelled alone, it appears, is a competent geologist and topographer, and he has not neglected anthropogeography, ethnology, or antiquities. Of the last there is comparatively little above ground, though indications are not wanting that the country had a fairly well-developed "Anatolian" civilization after about 1000 B.C. The rock-tombs form the most important remains, and there appear to exist, as in Phrygia, traces of "high places." But we should like to be sure that Prof. Leonhard was familiar with the look of ancient surface quarries before we accept his *Riesentrappe* and his rock-altar without reserve. The two maps, geological and topographical, are finely produced with much detail by R. Kiepert and fill a long-felt want. The plates and text-illustrations are very good indeed. D. G. H.

The Forests of China.

'Chinese Forest Trees and Timber Supply.' By Norman Shaw, B.A. London: T. Fisher Unwin. 1915. *Map and Illustrations.* 10*s.* 6*d. net.*

The subject of Chinese forests is undoubtedly attractive, for the extraordinary range of climate, due to the enormous expanse of varied regions which extend from Mongolia, Tibet, and Manchuria in the north to the coasts of southern China, has naturally contributed to clothe the widely dissimilar provinces with an extremely varied wealth of timber. The subject-matter of the present volume therefore clearly demands very detailed and careful treatment, and though the author knows a good deal about China it would have been impossible for him to traverse all the wooded regions and chief forests of so gigantic an empire. In default thereof, Mr. Shaw has ransacked with much diligence the available literature on the subject, and in addition to seventy-five well-known books of travel, has made search through a considerable number of Consular reports and Parliamentary papers, articles in the *China Review* and missionary journals, besides various papers in the *Proceedings* and *Journals* of this Society. It is only within recent years that a progressive spirit and conviction of the necessity of reform in forestry have become manifest in China, and the first step taken was the establishment in 1907 of a forest school at Mukden in Manchuria. A foreign adviser to the Bureau of Forestry at Peking was appointed in 1913 and efforts have since been made to extend the necessary organization. Part II. of this work contains a series of notes on Chinese forest trees which, with the aid of numerous photographs, may supply useful hints to those desirous of acclimatizing Chinese trees in countries of the West. Such notes as those on Conifers and Bamboos convey very suggestive information regarding the various uses to which these among other growths are devoted. The author, indeed, remarks, "The value of the bamboo to China cannot be overstated; it would be difficult to imagine how existence could be sustained in the south without this indispensable plant." Of palms, fourteen species are known to China which thus enjoys the benefit of another

well-known tropical product. The photographs, though not very numerous, are useful in illustrating the characteristic features of the country's timber products and vegetation. A better and more elaborate map would have been far more serviceable than the rough outline map supplied, for a great deal of the details as to the forests and topography are almost unintelligible without cartographical illustration.

'A Journey to Java.' By M. McMillan. (London: Holden & Hardingham, [1914]. *Illustr.* Pp. x., 286.) Many trivialities are included in this account of a voyage from Sydney to Surabaya and of a tour through Java. These very trivialities, however, often convey information which may be useful to tourists making a similar journey, and by industrious compilation the authoress has added to them a good deal of more substantial matter. Her own observations furnish particulars of the present development of Java as it presents itself to the passing traveller. Miss McMillan found that many changes had taken place in the island since Miss Scidmore published her 'Java, the Garden of the East,' in 1897. The addition of a map to the book would have been welcome.

AFRICA.

The Germans in Africa.

'The Germans and Africa.' By Evans Lewin. London: Cassell & Co. 1915. Pp. xviii., 317. *Map. Price* 10*s.* 6*d. net.*

Mr. Evans Lewin, the Librarian of the Royal Colonial Institute, has found the present time opportune for publishing a study of the part played by Germany in the partition of Africa. He begins by tracing the growth of German interests overseas from the seventeenth century, and the way in which they gave rise to the modern colonial movement. In a chapter on emigration from Germany Mr. Lewin gives particulars of the spread of German settlers all over the world, and shows how this loss of population from under the German flag stimulated the desire for German colonies. Having thus linked his subject to the causes of German *Welt-politik*, Mr. Lewin tells in detail the story of Germany's acquisition of her African territories and outlines her policy with regard to Morocco and the Congo. In two final chapters he attempts to estimate the failures and successes of Germany's colonial administration and discusses the future of German Africa. Like Sir Harry Johnston, Mr. Lewin assumes that Germany will not be allowed to retain any territorial holding in Africa after the war; but he takes more seriously than does Sir Harry Johnston the suggestion that German East Africa might be reserved for Japan, and he evidently favours the idea of the United States becoming an African Power. Earl Grey contributes an introduction in which he says that it may be questioned whether the British Empire would have benefited by adopting a dog-in-the-manger policy when Germany set about the task of acquiring African colonies.

Joffre's March to Timbuktu.

'My March to Timbuktu.' By General Joffre. Biographical Introduction by Ernest Dimnet. London: Chatto & Windus. 1915. *Sketch-map and Plan of Timbuktu. 2s. net.*

The interest of this record of General (then Major) Joffre's march to Timbuktu in 1893–94 lies chiefly in its revelation of the military qualities of the

man, now generalissimo of the Allied forces in France and Flanders. That interest is enhanced by the biographical details furnished by the Abbé Dimnet. Major Joffre had command of the land column which was to support Colonel Bonnier's advance on Timbuktu by the Niger. He started from Segu on December 27, 1892, and when at Gundam, on February 2, heard of the disaster to Bonnier's column on the 15th of the previous month. Joffre then had the responsibility of retrieving the situation. This he did in brilliant fashion, firmly establishing French authority in Timbuktu. It was his able leadership on this occasion which first caused Joffre to be noted by his superiors as a "coming man."

Joffre's narrative is the official report he drew up for the Ministry of the Colonies, and it was published in the *Revue du Génie* in 1895. Its appearance now in an English translation is timely, and as few people in this country can have seen the original report much of the information in it will be new. The description of Timbuktu "the mysterious," as it was when first occupied by Europeans, is valuable, as are also the notes on the Tuareg tribes. Joffre writes concisely and with an admirable precision, and displays a knowledge of his subject which shows that he had studied African problems to some purpose during the two years spent in superintending the building of the Kayes-Bafulabé railway previous to being called upon to undertake his march to Timbuktu.

F. R. C.

AMERICA.

Central Canada.

'La Saskatchewan; Essai de Monographie provinciale Canadienne.' By Louis Gilbert. Paris: "La Canadienne." [1914.] *Maps and Illustrations.*

For the material which is summarized or analyzed in this volume the official handbooks and year-books of the province of Saskatchewan, as well as various scientific publications, have been laid under contribution. The first part deals with the physical geography and includes a summary of the geology, climate, hydrography, fauna, and flora. The second part is devoted to a description of the electoral districts arranged in three groups, the southern prairies, the central park lands, and the northern forests. The third part deals with the history of the formation and settlement of the province, the past and present inhabitants, the progress of agriculture, industry, and commerce, the development of road, rail, and river transport, the mode of government, and the provision of educational facilities. The author concludes that in spite of the occurrence of immense deposits of lignite Saskatchewan is, and will continue to be, essentially an agricultural province, "the land of wheat, the centre of the granary of the Empire." During the years 1901 to 1911 no other Canadian province received such a large influx of agricultural colonists, the rural population being increased by over 287,000. The emigrants were mainly British or of British descent, but of foreigners Germans were most numerous, followed by Austrians, Scandinavians, French, and Russians in order of numbers. As in all the western provinces, the progress of settlement is closely related to the development of railway communications.

J. D. F.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Professor Huntington on Climatic Pulsations.

'The Climatic Factor as illustrated in Arid America.' By Ellsworth Huntington. With contributions by Charles Schuchert, Andrew E. Douglass, and Charles J. Kullmer. Carnegie Institution, Washington, Publication No. 192. 1914. Pp. vi., 341. 12 *Plates*, 2 *Maps*.

"The Solar Hypothesis of Climatic Changes." *Bull. Geol. Soc. America*, vol. **25**, 1914. Pp. 477–590.

Professor Ellsworth Huntington, in an important Carnegie Institution monograph, deals with the evidence afforded by the arid districts in Arizona and New Mexico and by some Central American states as to climatic variations within the historic period and their political influence. He was formerly a leading advocate of the view that there has been a progressive decrease in rainfall; he now holds that such changes in rainfall as may have happened followed an irregular pulsation. Probably most meteorologists would accept this conclusion; the weather is so complex and fickle that it must vary from year to year, and owing to the enormous masses in the air and in the ocean any considerable change in their circulation must take years to run its course, and the momentum must produce a slow oscillation. Whether the meteorological changes in the past two or three thousand years have been sufficiently great to affect political history is, however, doubted by many authorities.

In this monograph Professor Huntington calls attention to four chief lines of evidence. He refers first to alluvial terraces which are generally conspicuous in arid highlands; and he holds that they result from variations in the rivers owing to altered rainfall, as he rejects the alternative tectonic explanation. He next refers to changes in lake-levels as illustrated by a careful study of Otero Salt Lake in southern New Mexico. He then deals with the ruined settlements in southern Arizona and New Mexico and claims that they are so abundant that they indicate a formerly dense population and therefore a heavier rainfall and larger water-supply. Other explanations of the facts have been advanced by American archæologists, and various geographical features of these districts indicate that their climate was arid during the occupation of the ruined buildings.

The most important new evidence advanced in this monograph is the detailed statement of recent investigations on the variations in thickness of the growth rings in the big trees of California. Professor A. E. Douglass has shown that growth-rings vary with the character of the season and that trees record the general meteorological conditions in each year of their life. Trees may therefore give very important meteorological evidence, for their annual growth-rings are a measure of the combined influence of temperature, sunshine, monthly distribution of rain, evaporation, and length of the seasons. Professor Douglass in a valuable chapter summarizes the result of his work on this question and shows that the big trees of western America record meteorological cycles of eleven years, of twenty-one years during the past four hundred years, and of thirty-three years in the last two hundred years.

Professor Huntington has applied this method to the study of the Californian climate during the three thousand years covered by the life of the giant sequoias. He claims from the evidence of the trees that the climate of California during the past 3200 years has undergone important climatic pulsations, which have a length of centuries, but show no regular periodicity. He considers that these climatic pulsations in western America were synchronous with similar changes in Asia, though he points out that there are some striking contradictions and

that in these cases the tree record is probably wrong. Professor Huntington has investigated this difficult problem with great care and ingenuity, and he states the results impartially. He remarks that by taking a much larger number of trees than those cited by Professor Douglass the curves of precipitation "do not agree at all closely." There are many uncertainties. Thus the age of one half of a tree, according to its ring record may be three thousand years, and of the other half only two thousand five hundred years. Trees of different ages are differently affected by the same change; thus the heavy rain of 1899 and 1900 stimulated the young trees to more vigorous growth for fifteen years afterwards, while the older trees were unaffected. The five strips cut from different trees and shown on Plate IV. show striking differences, as in one the rings were wide in the earlier period and narrow toward the end and in others the conditions are reversed.

Professor Huntington then gives the evidence collected in an expedition to Yucatan. He describes the ancient inhabitants, the Mayas, as "the equals of the Greeks," and states that their art, architecture, and allied crafts showed that in that race "brilliant ideas must have been as numerous as among the Greeks." The decay of these people he attributes to climatic change, as an increase in rainfall led to the growth of a tropical jungle which it is beyond the power of modern man to clear and cultivate.

Two important chapters are contributed by Dr. Kullmer on the shifting of climatic zones and storm tracks, and by Professor Schuchert on the climates of geological time. The latter includes a valuable note by Professor Iddings on the Nan-t'ou boulder clay of China, which according to Professor Schuchert must be pre-Cambrian in age. If so, they were not contemporary with the ancient glacial deposits of South Australia. It may be noticed that the Upper Devonian is represented as a humid period, whereas in northern Britain it was arid, and that the Durness limestones are not now regarded as evidence of limestone formation in the Lower Cambrian.

In his final chapters, Professor Huntington discusses the causes of the climate changes and attributes them to variations in the sun and to crustal deformations.

The dependence of climatic changes on the sun is further advocated in the second paper, in which Professor Huntington discusses the various theories advanced to explain climatic variations. He considers, amongst other possible causes the diffusion of volcanic dust through the atmosphere by volcanic eruptions, and changes in the percentage of carbon dioxide in the atmosphere; but he rejects the former as too slight and the latter as too slow. He believes that the climatic changes are due to changes in the sun and are connected with sunspot cycles; but he attributes the solar influence not to direct changes in the heat received from the sun, but indirectly through its influence on the formation and distribution of storms; the effort, as he puts it, is cyclonic, not caloric. Professor Kullmer has pointed out, in a chapter of the Carnegie Institution Monograph, that storms have been especially numerous in periods of sunspot maxima, though it must be remembered that the next investigator might probably arrive at the opposite conclusion. At any rate, the data are not available for the application of Kullmer's method to an adequate period of time, but his tables and maps show some striking agreements with his rule. Professor Kullmer's full report on the subject has not yet been published, but Professor Huntington has been allowed to quote it extensively and reproduce several of its maps.

The latter part of Professor Huntington's paper discusses some recent literature in support of climatic uniformity, in opposition to the once prevalent belief in the progressive desiccation of the Earth; and as the authors quoted admit local

climatic changes during the historic period, Professor Huntington claims these conclusions as consistent with his own views, though there may be a serious difference as to the extent and importance of the changes recognized.

In conclusion Professor Huntington discusses the Permian glaciation and holds that it also can be explained by changes in the winds which led to the simultaneous development of deserts and ice-sheets. The title of Professor Huntington's suggestive work seems to indicate that he is an adherent of the astronomical theories of glaciation; but he regards the direct cause as meteorological, and he therefore is to be numbered amongst those who attribute former glaciations to changes in atmospheric circulation.

J. W. G.

HISTORICAL GEOGRAPHY.

Pedralvarez Cabral.

'Pedralvarèz Cabral (Pedro Alluarez Gouvea). His progenitors, his life, and his voyage to America and India.' By James Roxburgh McClymont. London: B. Quaritch. 1914. *7s. 6d. net.*

Mr. McClymont's life of Pedralvarez Cabral shows considerable research. His account of the Cabral family is certainly interesting, but he adds nothing to our knowledge of Pedralvarez himself, and does not give us quite all the old. Pedralvarez was not cast in heroic mould; his atmosphere is one of a weak personality brought face to face with events that would have taxed a strong man. His great opportunity came when he lay off Calicut from September to December, 1500; no life can be complete without a strict scrutiny of what he then did or omitted to do. Both Albuquerque and Duarte Barbosa blame their own countrymen for their conduct in this interval, conduct which they considered led directly to the massacre of Aires Correa and his following, but our author nowhere refers to the opinion of these distinguished men and practically passes over the whole episode in silence. There are ample materials for a discussion, and it would at least have put some flesh on Cabral's bones even if it did not reveal a hero. Our author missed a great opportunity when he did not publish a translation of Perovaz de Caminha's Diary on the discovery of the Brazils, where we get constant glimpses of Cabral. The paper should be translated for its own sake; it is an excellent account of the first meeting of Europeans with the natives of South America, and charming in its naïvete. The difficulties suggested as to the constitution of Cabral's fleet do not appear to have any foundation. If any confirmation of the usual authorities which give thirteen as the number of his ships is required it will be found in the king's letter on p. 61 of this volume. There are a few discrepancies in the names of the captains, but a little research would clear them up; for instance, besides Bartholomew Dias (the discoverer of the Cape of Good Hope), his brother had another ship. Some authorities give his name as Diogo, some as Pero—it was apparently the former—but he was one man and not two, and a jovial flesh and blood man at that, the musician and buffoon of the expedition. Of these thirteen ships, then, one (Luis Pirez) returned from the Canaries to report progress; one (Gaspar de Lemos) returned with the account of the Brazils; four (Bartholomew Dias, Aires Gomez, Simão de Pina, and Vasco d'Ataide) were lost in the squall in the South Atlantic; one (Diogo Dias) lost its way, wandered into the Gulf of Aden, but never reached India; the other six reached India, but one of them (Sancho de Toar's) was lost in the return voyage, and only five got back to Portugal. Taking everything into consideration it is not surprising that Pedralvarez was passed over when the

command of a subsequent expedition was discussed. The two main results of Cabral's voyage are: (1) The discovery of the Brazils, which was an accident; (2) the discovery of the rivalry between Calicut and Cochin, of which the Portuguese subsequently took full advantage, which was accidentally made after Cabral had failed before Calicut. On neither of these has Cabral's personality left any mark.

The text of the book under review would be better for some elucidation.

Page 23, "Cape of Bora Speranza" should be explained.

Page 24, "a name which suggests the modern name of Bora." This is said speaking of the Barbora of Duarte Barbosa, but is not helpful. Surely the name suggests the modern Berbera on the Somali coast.

Page 28, "the Five Reals (Quinas Reals)" seems hardly adequate as the designation of the Portuguese national emblem.

R. S. W.

GENERAL.

Educational.

'The Teaching of Geography." By B. C. Wallis. Cambridge: University Press. 1915. Pp. x., 222. *Maps and Illustrations.* 3s. 6d.

Here is a careful and in the main judicious treatise, by an experienced teacher, which should go far to remove any doubt (where such still exists) as to the high educational value of geography; indeed, its necessity as an educational subject. The exposition of method is often idealistic but avowedly and rightly so; the writer, for example, admits that he has not yet had the fortune to teach in a class-room and subsidiary rooms equipped as he desires, and, indeed, that his scheme "represents a much more complete and thorough arrangement than any which has yet been placed on record." But that is no reason for withholding his view of the perfect geography room. Again, it will probably be long before school hours admit of his teaching programme being carried out in its entirety, so far, for example, as concerns the handling and study of statistical details and other minutiæ. It is possibly with the importance of these in mind that the author does perhaps something less than justice to that branch of geography which deals with the future economic potentialities of various lands. He is fully cognizant of the value of geographical teaching in enabling the student, for example, "to foresee the limits of wheat expansion." It is not, then, quite clear why "the occurrence of minerals in nature is purely a geological matter; such deposits have no geographical significance until they are exploited, and the essential feature of the geographical significance of minerals lies in the sense of order which arises from the consideration of the reasons why some deposits are exploited while other deposits are left untouched." But this implies at least some knowledge of the unexploited fields. Although distribution maps which indicate, and books which describe, the existence of minerals by the same methods, irrespectively of whether they are worked or not, unquestionably err, yet the existence of great unworked fields should surely not be ignored, for towards the possibility or impossibility of their future development the faculty of imagination which geography develops should be directed.

There are many welcome passages in the book, which should be digested by many teachers, such as that which hinges upon the statement that "the modern teacher is not interested in topographical knowledge as such." The author's arrangement under which he discusses the sequence of teaching under

the headings of descriptive, transition, and systematic and argumentative geography, is profoundly interesting. On regional and economic geography his outlook (with the exception indicated above) is broad; on the relations of geography and history it is perhaps less so. His views as regards quantitative geography are well known to readers of this *Journal*: whether or not one may think they are pushed rather too far in this book, they demand close attention. It is hardly necessary to add that the use of maps and the globe, the methods of field-work, and the practices of teaching in the various departments of geography, are all expertly treated in this most interesting volume.

O. J. R. H.

Map Reading.

'Map Reading: A Self-instructional Manual.' By Captain L. Norcock, R.M.L.I., and Captain F. S. Wilson, R.M.L.I. London: Sifton, Praed & Co. 1915. *Price 4s. 6d. net.*

At the present time there must be a large demand for instruction in map-reading, and any work which is designed for self-instruction should receive careful consideration. The preface to this work explains that it is divided into two parts, the first dealing with methods and the second consisting of selected questions with full solutions.

It may be doubted whether the first part is sufficiently complete. Like the second, it consists rather of examples than of any explanation of general principles or methods. It is written throughout with an eye to the examination. For example, on the first page and the fifth line we read: "Diagonal scales: These are seldom set in examination papers. . . ." And although it would be a most useful book in the hands of a good instructor, it is more doubtful whether it is well designed to take his place; while some supervision in its use is the more necessary inasmuch as it contains a number of mistakes which might even have grave consequences.

Its authors follow the generality of books on military topography in stating that the edges of Ordnance Survey sheets may be taken as true north and south, whereas it is well known that they may deviate as much as 4° from true meridian. The authors perpetuate the undesirable definition of an angle as equivalent to a bearing; they continue to speak of spot-levels instead of spot-heights. They work problems of intervisibility without mentioning the fact that in ordinary undulating country the trees are frequently the decisive factor. They define "setting a map" as "placing it on the ground," which is a bad habit a pupil should be warned against rather than be encouraged in. But in addition to these usual defects, the authors make several unusual mistakes. They give as an example of a bench mark the usual sign for a "trig-point." They say that the true bearing of the sun at noon is 180° without specifying that local apparent noon is meant, or explaining how it is to be found. They say that the bearing of the Pole Star is always 360°. Worse still, on page 55 they answer the question, "What is the approximate bearing of the sun in England at 3 p.m. with a compass variation of 15° west?" by the following process: "The bearing on the sun at noon is 180°, and it moves at 15° per hour; hence at 3 p.m. its true bearing is 225°." This is an almost incredible error.

The authors are not happy in their arithmetic. In working question 8 on page 41, and in many other places, they use 1 in 60 as the equivalent of 1°, and immediately afterwards 1 foot in 19·1 yards. In the example worked on page 53 they start with data to one significant figure, and in a few lines arrive at the result that "in five minutes the torpedo-boat travels 1018·67 yards."

The self-instructed are thus confirmed in one of the most common faults—waste of time in arithmetic.

These various defects make the book a dangerous guide to the uninstructed; but they do not appreciably diminish its value as an exercise book for those under good instruction; and it is to be hoped that for this purpose it may be widely used, and the enterprise of its authors suitably rewarded.

An Illustrated Geography.

'Illustrierte Länderkunde.' By Ewald Banse and others. Brunswick, etc.: G. Westermann. 1914. *Map and Illustrations.*

The purpose of the authors has been to produce an authoritative compendium of modern geography of moderate size and reasonable price. The usual subdivision of the Earth's surface into continents has been discarded in favour of a subdivision into what might be termed cultural regions, which to the authors is the only true method of viewing the globe. The regional divisions adopted are the Orient (Asiatic and African), Europe (excluding Russia), Greater Siberia (including Russia and Northern Asia), Mongolia or Highland Asia, Eastern Asia, India (or southern Asia), Greater Australia, Nigritia (or African south of the Sahara), East South America, Andina, Central America, Cordilleria, America (east of the Rockies), Arctis, and Antarctis. These major regions are then subdivided into minor climatic and topographical regions, which are discussed and compared from the point of view of the effect of varying natural conditions upon the general cultural type. The plan of the work is discussed in the introduction and the principles there enumerated are consistently followed throughout the various sections. The limited size of the volume has necessitated careful selection of the facts presented for consideration. Each section, however, is written by a specialist, and the result is a highly interesting and suggestive, as well as well-illustrated, volume, which may be commended to the careful attention of anthropogeographers.

J. D. F.

THE MONTHLY RECORD.

EUROPE.

Distribution of Population in Sardinia.—An interesting study of the distribution of population in the island of Sardinia is contributed by G. Anfossi to the *Bolletino* of the Italian Geographical Society, 1915, Nos. 2 and 3 (also in abridged form in *La Geografia*, May–June, 1915). Besides presenting the data in tabular form the article is well provided with sketch-maps and diagrams showing the distribution of inhabited centres, the distribution of density in 1861 and 1911, the distribution of variation in density (chiefly increase) during the half-century, the distribution by altitude, and so on. The increase for the whole island reaches the high value of 45 per cent. during the half-century—greater than that for Italy as a whole (39 per cent.). The distribution of the increase is rather striking, most of the north and east showing over 50 per cent., and a considerable area in the extreme north-east over 100 per cent. (reached also over limited areas in the south and south-west). Mining development is no doubt largely responsible for the increase in the Iglesiente. Generally speaking the greatest increase is in the parts that were most sparsely populated in 1861, and this indicates a considerable shifting of population. The island has tended towards a more equal distribution of

population helped by the improved communications. The distribution by altitude is interesting. While the highest density and still more the greatest actual numbers are naturally found in the lowest zone (0 to 100 metres), there is a remarkable rise in both in the zone between 200 and 600 metres, which is, next to the coast, the most densely peopled. This is the case generally all over the island rather than in any particular districts, so that there seems to be a definite predilection for these altitudes on the part of the people. All the zones show a nearly consistent increase during the half-century. Still, the rate has been greatest in the lower zones and the proportion of the total population concentrated in these has risen. The mean altitude of the population as a whole has decreased from 279 metres in 1861 to 275 metres in 1911, the mean altitude of the island itself being 344 metres.

ASIA.

The Dipterocarp Forests of the Philippines.—It has been a current idea that the forests of the tropics cannot compete with those of temperate regions as a source of timber supply for general construction purposes, by reason of their mixed character and the hardness of the individual woods. This is far from the case with the dipterocarp forests so largely developed in the tropics of Eastern Asia, which almost resemble the coniferous or cupuliferous forests of Europe in the gregarious character of many of the species and in the soft or medium-hard character of their wood. The dipterocarp forest is tall tropical lowland forest characteristic of the Indo-Malayan region, the dominant trees being species of the family *Dipterocarpaceæ* which includes the well-known Sal (*Shorea robusta*) of India. An interesting study of the distribution, relation to environment, and exploitation of such forests in the Philippines, where they are supposed to cover 75 per cent. of the virgin forest area, or 30,000 square miles, is contributed to the *Philippine Journal of Science* (September and November, 1914) by Messrs. W. H. Brown and D. M. Matthews as a result of personal investigations from the points of view of the botanist and the forester. The distribution of the forests is shown by means of a sketch-map and the chief factors governing it are clearly explained in the text. They usually grow best on well-watered plains or on the gentle lower slopes of the mountains, where the soil is generally a deep loamy clay of volcanic origin. As regards climatic influences moisture seems to be the determining factor, temperature playing but little part. The *régime* of the prevailing winds, coupled with the physical configuration of the islands, brings it about that while the western half of the archipelago has a seasonal rainfall (derived from the north-east monsoon), in the eastern half the rainfall is distributed throughout the year. This is reflected in the distribution of the forests which are most extensive on the eastern side. It is probable, however, that the whole of the islands were once much more evenly forest-clad and that the present large extent of grass-lands is the result of former destruction of the forests for cultivation and the subsequent invasion of the rampant cogon grass (*Imperata exaltata*). This is especially injurious in the areas of seasonal rainfall, owing to the inflammable nature of the grass in the dry season and the resulting destruction of tree seedlings. Human destructive activity has been aided by climate in the western and retarded in the eastern half. A characteristic of the dipterocarp forests is the arrangement of the trees in three more or less distinct stories (resulting in great density of foliage), the highest often exceeding 200 feet in height and composed chiefly of dipterocarps, which form a very even canopy. This applies to the best developed forests, but there are great variations according to the proportions which the dipterocarps bear to the rest of the trees. The authors describe in detail various individual forests and discuss their environmental conditions, besides considering the most

suitable methods of management. This seems to present some difficulties, and special precautions are necessary to provide for the regeneration of the forests when cut over.

AFRICA.

Bartholomew Dias on the South Coast of Cape Colony.—The identification of the points touched at by this Portuguese navigator on the coast of Cape Colony after successfully passing the Cape of Good Hope is a matter of some difficulty, and has received a good deal of attention on the part of commentators. The question of his turning point in particular was discussed a year or two ago by Prof. Schwarz (*Journal*, vol. **41**, p. 595), who suggested that the Rio do Infante was not the Great Fish River, as has been generally supposed, but the Kowie. The latest and in some respects the most satisfactory examination of the question, with special reference to the point where the last pillar commemorating his voyage was set up by Dias, is that of Ernesto de Vasconcellos, contained in a small collection of articles by him on historico-geographical questions, lately reprinted at Lisbon. The writer carefully examines all the original authorities for the voyage, in the light of other early descriptions of the coast in question (by Duarte Pacheco, Perestrello, and others) and modern knowledge as expressed in the British Admiralty charts. He brings out clearly the causes of confusion which have existed by reason of the inconsistencies of the early nomenclature, and the duplication of names like those of Ilha da Cruz, Alagoa Bay, or Penedo das Fontes. These are shown conclusively to be applied by different writers to different parts of the coast, *e.g.* the Alagoa Bay of Duarte Pacheco cannot be identical with the modern Algoa Bay, but must lie to the west of it. From a comparison of all the accounts two points clearly emerge, viz. that the Chãos Islands of the old writers correspond to the Bird Islands of the modern charts, and that the Ilha da Cruz 5 leagues farther east (otherwise called Penedo das Fontes), where Dias set up the pillar of São Gregorio on a rock presenting the appearance of a caravel, can be no other than the False Islet of the present day. This owes its name to the fact that it is really joined to the mainland as described in some of the old narratives. Thus João de Lisboa, whose 'Livro de Marinharia' was for the first time made available in 1903 (*Journal*, vol. **23**, p. 512), says that 5 leagues from the Chãos "se faz na ribeira um ilheu pegado á terra . . . e este ilheu não é cortado do mar, é um morro de pedra que parece ilheu e sobre este ilheu está o padrão de S. Gregorio." The Fountain rocks placed by the English charts near the mouth of the Kowie cannot in this case be the Penedo das Fontes, and their name must be due to a mistake on the part of the cartographers. The views of the Portuguese writer are therefore not in accordance with that of Prof. Schwarz, the Kowie being identified by the former with one of the small streams placed by Duarte Pacheco before (*i.e.* west of) the Rio do Infante.

AMERICA.

The Interior Plateaus of British Columbia.—Although dealing primarily with a limited part of these plateaus a discussion by Mr. L. Reinecke of the physiography of the Beaverdell map area, which forms *Museum Bulletin* No. 11 of the Geological Survey of Canada, is of interest, not only because that area is more or less typical of a large part of the interior of British Columbia, but because of its bearing on the question of physiographical development of surface features in general. While adopting in the main the modern doctrine of the geographical cycle the author is alive to the need of caution in its application. The region of interior plateaus is about 500 miles long by 100 wide, and consists essentially of areas of rolling upland separated by deep valley trenches. In the south the general level of

the uplands is from 4000 to 6000 feet above the sea, the elevation decreasing towards the north. The valleys lie from a few hundred to over 4000 feet below the upland surface which passes abruptly into the steep valley wall, so that the plateaus are divided into topographically distinct upland and valley portions. The deeper valleys divide the upland into a number of blocks and there is a general disposition towards parallel and rectilinear arrangement both of valleys and ridges. The valleys themselves present distinct types, being wide and shallow on the uplands, whereas those which have entrenched themselves deeply may be of the V-shaped canyon type or the U-shaped deep-trench type due to glacial action. The bottoms of the larger ones are flat and sometimes one or two miles wide, offering advantages for fruit ranching. Some of the U-shaped type are made up of a series of terraces, and remnants of such terraces are also found above the steep V of the canyon type. The writer lays stress on the importance of estimating the relative relief or average regional slopes of any area studied, for by reason of the composite nature of existing landforms—the product of more than one cycle of erosion—hypotheses of origin are apt to lead to more speculation than seems warranted. But there is almost certainly a definite diminution of average slope after a region has passed the stage of early maturity, such diminution becoming very slow during the later stages of old age. The term "peneplain" is, Mr. Reinecke remarks, applied alike to uplands with average slopes of 160 to 300 feet to the mile and to plains with slopes of less than 10 feet to the mile, though the former are further removed in time from the latter than from rugged mountains.* Summing up the physiographical history of the southern interior plateaus, the writer believes that they were rugged and mountainous in early Tertiary times, and that later, after reaching the stage of late maturity, the country was uplifted and deeply dissected, the main valleys being subsequently remoulded and partly scoured out by a continental ice-sheet. The valley terraces were due to a variety of conditions acting after glaciation had ceased. To-day the cycle of erosion as seen in the valleys is in the stage of youth, though the old surface represented by the upland still covers three times the area occupied by the valleys.

The Takutu River, British Guiana.—In a communication addressed to us from Thapokaroo, British Guiana, the Rev. Walter G. White maintains that our maps are in error in marking as the Takutu the river which runs south to the Amazon from the neighbourhood of the frontier between British territory and Brazil (cf. map accompanying Mr. de Villier's paper in *Journal*, vol. **38**, p. 112), and is formed by the junction of the Ireng from the north and the Takutu proper from the south. The Ireng, he says, is the true upper course of the river, and this is indicated by the usage of the natives who use the name Mohu (Mahu on the map referred to above) both for the Ireng and for the combined stream further south. Mr. White does not state whether his view that the Ireng is the larger stream is based on personal inspection, but he lays stress on the "unnatural" curve made by the Takutu if the combined river below the junction is so designated, as compared with the uniform course from north to south maintained by the Ireng-Mohu. Some weight may no doubt be conceded to this, but geographers will hardly allow the consideration to be in itself decisive.

POLAR REGIONS.

Safety of Mr. Stefánsson.—The gratifying intelligence was received by telegraph from Ottawa, on September 17, that Mr. Stefánsson, for whose safety

* Does not the writer here miss the distinction between an original and a dissected peneplain? An upland such as he speaks of could surely never be regarded as a peneplain in its present form, but rather as the remains of an old peneplain.

grave fears had been entertained in some quarters (*Journal*, vol. **45**, p. 442), owing to the absence of all news from him since April of last year, had safely returned to his base in northern Canada. The confidence of those of his friends who trusted to his remarkable powers of adaptation to adverse circumstances had thus happily been justified. A despatch sent by the explorer to the *Daily Chronicle* and printed in that journal on September 20 outlines the experiences of himself and his companions during the past eighteen months. On sending back his last supporting party on April 17, 1914 (*Journal*, vol. **44**, p. 59), Mr. Stefánsson was provided with food for men and dogs for about forty days and had 360 cartridges for two rifles. His companions were the Norwegians Andersen and Storkersen. A violent gale set in two days later, but this was the last trouble of the kind experienced. Cold weather came at last, and the difficulties from water lanes ceasing rapid progress was made. The easterly drift which had been kept in view as a possibility proved a reality and though a course was set well to the west of north, the actual course followed was true north. By April 27 the party were near the intersection of 70° N. with 140° west. Much thin ice had been crossed and (with the increasing warmth) threatened soon to become impassable, so it was thought safer to proceed towards Banks Island than to attempt the return journey of 240 miles to the continent. The failure of the kerosene and shortage of food involved the party in some hardships, but seals and bears were fortunately obtained. An easterly gale and the presence of a wide lead in front delayed progress, and the party drifted 60 miles further from their destination. Later the drift was southerly, and though they set a north-easterly course they were carried south-east so as to strike land some 30 miles south of Cape Alfred (west coast of Banks Land), ninety-six days out from Martin Point, Alaska, during which 700 miles had been covered. From soundings frequently taken *en route* it appeared that the sea-bottom rises in at least three terraces towards Banks Island. Though often sighted by whalers, this island, Mr. Stefánsson says, had not been visited by a white man since M'Clure's abandonment there of the *Investigator* in 1854. By hunting caribou a good supply of meat was obtained, but though a navigable channel remained open inshore of the ice-barrier no sign was seen of the *North Star*, the schooner ordered by Mr. Stefánsson to proceed to his relief. Caching their dried meat the three travellers therefore went south along the coast and found the other vessel of the expedition, the *Mary Sachs*, in winter quarters at Cape Kellett. The explorers had, it seems, unwarrantably been given up for dead. During the winter Mr. Stefánsson, with one Eskimo, made a 400-mile trip to the south-east of Banks Island and Victoria Island in search of Eskimo, but none were found, and the hope of obtaining dogs from them failed. The new sledge-expedition began in February, 1915. Some delays occurred, and Cape Alfred was not left till early in April, 75° N. being reached on April 26. Here the sea ranged from 150 to 200 fathoms in depth. Travelling was dangerous owing to the thinness of the ice, and early in May open water had to be crossed on extemporized rafts. Attempts to make westing had to be abandoned and a course was held parallel to the west coast of Prince Patrick Island. Proceeding north under considerable difficulties and completing the charting of the coast begun by M'Clure, Stefánsson reached the north point of the island on June 15, and on the 18th new land to the north-east was sighted by Storkersen. Next day a landing on it was effected in about 78° N. and 117° W. The coast trended from north-west to a little south of east, and was followed for three days in the latter direction when the lateness of the season compelled a return. About 100 miles of the coast were seen, but mountains of an altitude of 2000 feet were visible 50 miles further east, and still higher ones inland in all directions. The start back was begun on June 22, by which

date geese and other birds had arrived and the rivers were breaking out. Some new islands were discovered between the new land and Melville Island, the west coast of which was followed south. Passing over to the Bay of Mercy the party crossed Banks Land diagonally to Cape Kellett and thus completed a successful trip. Whether the new land will prove more than an island similar to others of the Northern Canadian Archipelago must be left to future work to decide. Mr. Stefánsson hopes to continue his explorations and has purchased another schooner, the *Polar Bear*, to take up supplies for next year's operations.

Return of Expeditions from the Siberian Seas.—The expedition under Captain Vilkitski in the ice-breakers *Taimur* and *Vaigach*, which last year started from Vladivostok to renew the attempt to reach Europe by the Arctic Sea north of Asia (*Journal*, vol. **45**, p. 253), and which wintered in 100° E. long. off the Taimur peninsula, reached Archangel during September, having thus for the first time accomplished the complete north-east passage in the reverse direction from that followed by the *Vega*. It will be remembered that during his first attempt (in 1913) Captain Vilkitski was rewarded by the discovery of new land north of Cape Chelyuskin (*Journal*, vol. **42**, p. 466; **43**, p. 64), but that the state of the ice frustrated his efforts to complete the voyage to Europe. News has also been received of the return of the search expedition of Captain Sverdrup (*Journal*, vol. **45**, p. 253), without finding any trace of the lost Russian parties under Brussilof and Russanof respectively. All hope of their safety must therefore, we fear, be now abandoned.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

The Thermal Relations of Lakes in Europe and America.—The thermal properties of European and American lakes on the basis of their "heat budgets" form the subject of a treatise by Edward A. Birge, published as Part I., vol. **18**, of the *Transactions of Wisconsin Academy of Sciences, Arts and Letters* (Jan., 1915). For the purposes of the investigation two quantities may be understood by the expression "heat budget": either (1) the amount of heat necessary to raise the temperature of a lake from the minimum in winter to the maximum in summer; or (2) the amount of heat necessary to raise the water from 4° C. (maximum density) to the summer maximum. The first is called the *annual heat budget*, the second the *summer heat income*, or, for reasons referred to in the treatise, the *wind-distributed heat income*, but the conclusions to be drawn from the two types of budget are very similar. Of three methods of expressing the heat budget of a lake in either of the above forms, one due to Forel, one to Halbfass, and the third to Woeikof and Wedderburn, the last is shown to be the only one applicable to the comparative study of the budgets of lakes differing widely in form and area, but similar as regards topographical and climatic conditions. It takes count of the total number of calories necessary to warm a column of water of unit base and of height equal to the mean depth of the lake from the selected minimum (4° C. or winter minimum as the case may be) to the summer maximum. The computations of the author for the various lakes are based upon a series of temperature observations, as carefully compiled by Halbfass and others, conducted in different years at the central part of the lakes, which, Birge maintains, affords a fairly good idea of the mean temperature of the whole body of water provided certain hydrographic conditions are known. For some lakes only one year's budget is calculated, for others several, the mean of which is then taken; so that the possible effect of abnormal seasons must render the results only provisional. Whereas twenty-six European lakes are represented in the comparison, the American lakes only number seven, six belonging to New York (cf. August number, p. 155), and one to Wisconsin. The tabular statement of results shows that the mid-European lakes have

on the average very small budgets in comparison with the American, which latter have a warmer "epilimnion," the summer temperature in the upper strata falling less abruptly from the surface, a feature strikingly exemplified by the August temperature curves of Cayuga lake contrasted with those of the Würm-See. Concerning the influence of latitude no clear relationship is brought out by these results, which therefore do not support Forel's theory that northern lakes with their colder upper strata have greater heat budgets than those farther south. In Europe three of the largest annual heat budgets are revealed by the Lake of Geneva (36,600 gram cals. per sq. cm. of the surface), Loch Ness (37,200), and Lake Mjösen in Norway (37,000). Geneva, which is conspicuously high among the Swiss lakes, as is Ness among the Scottish, shows also a higher average budget than the Lake of Como in the same latitude on the other side of the Alps, the main cause assigned being the colder winter "which reduces the temperature to a point where the heat can be more readily absorbed than is possible in Como." It is pointed out as surprising that the Scottish lakes with their cool summer should show such large gains of heat as they do, but it is asserted that continuous sunshine is not especially favourable for large gains of heat, as it warms the surface too rapidly.

GENERAL.

Wilson Memorial at Cheltenham College.—Captain Scott's trusted companion, Dr. E. A. Wilson, who perished with him in the Antarctic, was educated at Cheltenham, and after his tragic death it was decided to erect a memorial to him in the College Chapel. This was unveiled on September 18 in the form of a tablet with suitable inscription. A life-sized portrait by Mr. Hugh Riviere has also been placed in the College Library, and was unveiled at the same time.

OBITUARY.

Andrew John Herbertson.

The study and more particularly the teaching of geography in this country has suffered a grievous loss by the death, on the last day of July, of Prof. Herbertson of Oxford. In the not very long list of his fellow-countrymen who up to the present time are justly entitled to be called in a comprehensive sense trained geographers, his name is eminent. That list was distinctly smaller when he first decided to devote himself to the subject; and in no inconsiderable degree, its recent extension can fairly be credited to his work, most of all since he became head of the School of Geography at Oxford, a university institution which owes very much to the support, material and otherwise, of this Society.

Mr. Herbertson was born in 1865 at Galashiels, where his family, headed by his father, to whose just and exact habit of mind all the sons owe a great deal, still lives. Immediately after his school years at Galashiels Academy and the Edinburgh Institution he served a term with an Edinburgh firm of surveyors, and no doubt here strengthened a bent towards practical life and business which remained with him throughout his subsequent academic career.

In the later eighties Edinburgh became his first university. Here he was, for example, a distinguished pupil of P. G. Tait in experimental physics, and in large measure under the inspiring influence of his friend, Patrick Geddes, he felt the permanent attraction of social studies and problems. A letter written at this period to a younger brother which the writer of this notice has seen proves what a remarkable appreciation young Herbertson already had of values in education,

and of the need for developing in a child the special faculties of sense and imagination, and above all respect for truth in their use. His interests were turned to Scottish meteorology, as were Tait's own about this time. Work under Dr. Alexander Buchan at the Ben Nevis observatory and elsewhere followed, and, both then and later, association with H. R. Mill and W. S. Bruce in oceanographical studies. Later educative influences were those of the French Leplay school, of Flahault at Montpellier, and of Neumann at Freiburg. The University of Freiburg conferred their Doctor's degree for the important dissertation on the "Monthly Rainfall over the Land Surface of the Globe," afterwards printed with a slightly altered title as an extra publication of the R.G.S.

A varied preliminary training such as has been outlined formed a good equipment for higher geographical teaching, of which Dr. Herbertson made full use as lecturer both in the Heriot-Watt College, Edinburgh, and at Owens College, Manchester, before his appointment as assistant to the reader (Mr. H. J. Mackinder) at Oxford when the school there was founded in 1899. As years passed, an increasing share of the geographical work at Oxford fell upon him, and he was appointed successively Lecturer in Regional Geography, and, on Mr. Mackinder's resignation in 1905, Reader in Geography. In 1910 Convocation of the University conferred upon him by unanimous decree, as some acknowledgment of his important services, the personal title of Professor. The years of these Oxford appointments correspond with the publication, with Bartholomew, of the Great Atlas of Meteorology (1899), and of the fundamental paper on Major Natural Regions (*Geographical Journal*, 1905), and with Prof. Herbertson's presidency of the geographical section of the British Association (1910).

Most of his later original work was directed to the working out of the Natural Region as a geographical unit; but he had long ago formed the opinion that progress in the university teaching of geography was held back by defects in the school teaching, and it may be said with truth that to a deliberate preoccupation for many years in the improvement of the elementary text-books—a task in which his wife gave him invaluable aid—he somewhat sacrificed high powers as an investigator. Of Prof. Herbertson's other and many activities, only summary mention can be made of the now flourishing Geographical Association, whose hon. secretary he had long been; of the Royal Commission on Canals and Waterways, of which he was a member; and of the preparation of an entirely new series of educational wall maps; and the joint editing, with Mr. O. J. R. Howarth, of a magistral Survey of the British Empire, in six volumes. In every one of these his share in the work was great, when it was not all-important.

Prof. Herbertson died at his house at Chinnor in the Chiltern Hills, and was buried at Oxford on August 2; the funeral service in the chapel of his college, Wadham, was largely attended by members of the University and others, including representatives of the Society. This short notice may fitly close in the terms of the resolution passed by the Oxford Committee for Geography, when it placed on record "its deep sense of the loss sustained by the University owing to the death of the late Reader (Prof. Herbertson), and" desired "to express its appreciation of the great services which he has rendered to the study of geography at Oxford." The loss is not one that is sustained by Oxford alone.

H. O. Beckit.

Sir Claude Macdonald.

It is with great regret that we record the sudden death from heart-failure, on September 10, of Colonel Sir Claude M. Macdonald, G.C.M.G., G.C.V.O., K.C.B., a Fellow of this Society since 1899 and for the past two years a valued member of its

Council. It is for the latter part of his active career—as a diplomatist in the Far East—that he has no doubt been best known to the public, and this left him little opportunity for actual geographical work, but it was for its geographical equally with its political results that one of his first missions under the Foreign Office was noteworthy—that to the Niger in 1889—and it is with this that we are here chiefly concerned.

Born in 1852, the son of the late Major-General J. D. Macdonald, Sir Claude was educated at Uppingham and Sandhurst and entered the army in 1872 with a commission in the 74th Highlanders. In 1882 he served with distinction in the Egyptian campaign, obtaining the Brevet rank of Major and becoming Military Attaché to the British Agency at Cairo—a post which he held till 1887. He served also in the Suakim campaign of 1884-85. In 1887-88 he was Acting Agent and Consul-General at Zanzibar, and in 1889 he went to West Africa with a special commission from the Foreign Office. British influence had then been lately established over the Niger territories, thanks to the enterprise and determination of the National African Company and its successor the Royal Niger Company, which had obtained its charter in 1886. Major Macdonald (as he then was) was directed to report on the general state of affairs in the new territories. Besides visiting the stations on the Niger he carried out an important voyage up the Benue, to which river the Company had also extended its operations. Its upper course and tributaries were but imperfectly known, and the results of the voyage were of distinct geographical value—particularly the map then made for the first time of the north-eastern branch, the Mayo Kebbi, which had been previously the subject of a good deal of speculation, being supposed to form a link of communication between the Niger and Chad systems through the great Tuburi marsh, visited by Barth's colleague, Dr. Vogel, in 1854. Macdonald and his companion, Captain Mockler-Ferryman, ascended the stream in a stern-wheeler belonging to the Royal Niger Company, reaching a point where the increasing shallowness made further progress impossible, and which was thought to be probably only some 3 miles from its source, though 20 or so from the nearest point of the Tuburi swamp. It was reserved for French explorers some years later—particularly Captain Lenfant—to trace the remarkable water-connection which does exist between the Benue and the basin of Lake Chad, though the English travellers did good service by supplying a map of the navigable stretch of the river.* The exploration was described by Major Macdonald in a paper read before this Society in May, 1891, and also in a book by Captain Mockler-Ferryman ('Up the Niger,' London, 1892), which gave a general account of the course and results of the mission.

In 1891 Macdonald became Commissioner and Consul-General for the Oil Rivers Protectorate, the name by which part of the coast territory of Nigeria was then known, and accompanied Admiral Bedford in the expedition against the natives on the Brass River, obtaining the medal with clasp for his services. In 1896 he received the important appointment of British Minister to Peking and as such went through the stirring times of the Boxer rebellion. During the siege of Peking in the summer of that year he was placed by the general vote of the Foreign Representatives in command of the Legation quarter. For his services in this connection he was promoted Colonel in the Reserve, and became Knight Commander in the Military Division of the Order of the Bath (he had been civil K.C.B. since 1898). Before the end of 1900 he was transferred to Tokyo as British Minister to Japan, a post which he retained till his retirement in 1912.

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* With his customary acumen, Barth had rightly regarded the Tuburi swamp as in part a feeder of the Mayo Kebbi, though he had not himself visited the locality.

Julius von Payer.

The death on August 31 of our Gold Medalist, the Arctic explorer Julius Payer, has been announced by German wireless. Some particulars of his early life are given by the translator of the English edition of his book, 'New Lands within the Arctic Circle,' which described the course of the famous *Tegethoff* expedition by which the discovery of the Franz Josef Land Archipelago was made. Born in 1841 at Schönau in Teplitz, Bohemia, Payer received a military education, taking lessons in Geography from General von Sonklar, from whom he imbibed the love of the grandeurs of the world of ice which so much influenced his after career. He served with distinction in the campaign of 1866 in Italy, and subsequently gained celebrity as an Alpine climber in Tirol, where he did good work by his surveys among the Orteler Alps and glaciers. In 1869–70 he took part in the second German Arctic expedition to East Greenland under Koldewey and Hegemann, doing valuable service and gaining experience which he put to account later. In the summer of 1871 he was associated with Lieut. Weyprecht, of the Austrian navy,* in the command of the pioneer expedition made by the *Isbjörn* (Ice-bear) in preparation for a contemplated more ambitious undertaking made possible by the munificence of Count Wilczek. The field chosen was the sea between Novaya Zemlya and Spitsbergen, which had been neglected by explorers since the early days of Dutch and English Arctic enterprise, and which was quite unknown in its northern part. The aim of this preliminary voyage—the acquisition of data on the general physical conditions in those waters—was successfully accomplished, and in 1872 the main expedition sailed in the *Tegethoff* under the joint command of Payer and Weyprecht. The expedition was unfortunate in the imprisonment and final loss of the ship in the ice, which frustrated the original plan of completing the north-east passage by passing north of Novaya Zemlya and so on to Bering Strait. But the protracted drift of the ship to the north brought its reward in the discovery of the extensive Franz-Josef Archipelago, which was explored as far as possible by sledge-expeditions. In recognition of their achievement the two commanders received the two Gold Medals of this Society in 1875, and an English version of Payer's narrative appeared in the following year.

Payer was possessed of no mean talent as an artist, and his delineations of Arctic scenes gained a good deal of celebrity. Many years later he planned a new expedition to the Arctic Regions for artistic purposes, as described in this *Journal*, vol. 5, pp. 106–112. But this was never carried out. Only some two years ago his son, M. Jules de Payer, who had become naturalized as a French citizen, came forward with plans to complete his father's work by a scientific exploration of the north-east part of Franz Josef Land. A preliminary trip was made in the summer of 1913, but the war has prevented the carrying out of the main undertaking.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are as a rule written in full:—

* Although in the Austrian service, Weyprecht was a German by birth. He was born at Darmstadt in 1838.

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C.R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Gen. = Genootschap.
Ges. = Gesellschaft.
I. = Institute, Institution.
Int. = International.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
Jber. = Jahresbericht.
k.(k.) = kaiserlich (und königlich).
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps—Structure. **Blanchard.**

Recueil Travaux I.G. Alpine (Grenoble) **3** (1915): 163–227.

La structure des Alpes. Par Raoul Blanchard. *Illustrations.*

Alps and Pyrenees—Denudation. *C.R. A. Sc.* **160** (1915): 462–467. **Müntz and Lainé.**

Etudes sur la formation des limons et leur charriage par les cours d'eau dans les Alpes et les Pyrénées. By A. Müntz and E. Lainé.

Bulgaria. **Launay.**

L. de Launay. La Bulgarie d'Hier et de Demain. 3e édn. Paris: Hachette et Cie., 1912. Size 7½ × 5, pp. 494. *Illustrations.*

Europe—Languages. *B. American G.S.* **47** (1915): 401–439. **Dominian.**

Linguistic areas in Europe: Their boundaries and political significance. By Leon Dominian. *Maps.*

See note in September number, p. 237.

Europe—War. *B. American G.S.* **47** (1915): 175–183, 265–277. **Johnson.**

Geographic Aspects of the War. By Douglas Wilson Johnson. *Diagram and Illustrations.*

France—Alps. *La G.* **30** (1915): 257–268. **Rabot.**

Récents travaux glaciaires dans Alpes françaises. By Charles Rabot.

Italy—Colonies. *La Geografia* **3** (1915): 168–179. **Graziani.**

La guerra europea e l'avvenire coloniale italiano. By Giovanni Graziani.

Italy—Earthquake. **Martinelli.**

Atti R.A. Lincei, Ser. V., *Rendiconti* **24** (1915): 1218–1224.

La frequenza nelle repliche del terremoto italiano (13 gennaio 1915). By G. Martinelli. *Diagram.*

Italy—Lake Garda. *La Geografia* **2** (1914): 122–131. **Taramelli.**

Sulla storia geologica del Garda. By Torquato Taramelli. *Map.* Also separate copy, size 9½ × 7, pp. 10.

Rumania. **Seton-Watson.**

Roumania and the Great War. By Dr. R. W. Seton-Watson. London: Constable & Co., 1915. Size 9 × 6, pp. 102. *Maps. Price* 2*s. net. Presented.*

Scandinavia—Temperature. **Hamberg.**

Appendice aux observations météorologiques suédoises . . . vol. 54. 2ième série: vol. 40. 1912. Grandeur de la variation diurne de la température dans la péninsule Scandinave. Par H. E. Hamberg. Upsala, 1914. Size 12 × 10, pp. 71. *Maps.* [In Swedish and French.]

Serbia. **Petrovitch.**

Serbia. Her people, history, andaspirations. By Woislav M. Petrovitch. London;

G. G. Harrap, 1915. Size 8 × 5¼, pp. 280. *Sketch-map and Portraits. Price* 3*s.* 6*d. net. Presented.*

Sweden—Geomorphology. *Z. Gletscherkunde* **8** (1914): 343–349. **Werth.**

Zur Oberflächengestaltung der südschwedischen Halbinsel. Von E. Werth. *Sketch-map.*

Turkey—War Theatre. *G.Z.* **21** (1915): 305–321. **Frech.**

Der Kriegsschauplatz am schwarzen Meer und in Transkaukasien. Von F. Frech. *Illustrations.*

United Kingdom—Severn. **Lanchester.**

The River Severn from source to mouth. By M. Lanchester. London: T. Murby & Co., [1915]. Size 9 × 5½, pp. viii. and 72. *Sketch-map and Illustrations. Price* 2*s.* 6*d. net. Presented.*

ASIA.

China—Exploration. *La G.* **30** (1915): 308–310. ———

Note sur les travaux topographiques de la mission Voisins-Ségalen-Lartigue dans la Chine occidentale, 1914. *Sketch-map.*

See note in the September number, p. 240.

India—Historical. **Foster.**

The English Factories in India, 1651–1654. A calendar of documents in the India Office, Westminster. By William Foster. Oxford: Clarendon Press, 1915. Size 9 × 6, pp. xl. and 324. *Illustration. Price* 12*s.* 6*d. net. Presented.*

India—Vizagapatam. ———

Correspondence relating to the proposed Raipur-Vizagapatam railway and Vizagapatam harbour. N.P., [1915]. Size 8½ × 5½, pp. 28. *Map.*

See note in the July number, p. 154.

India and Ceylon—Railway. *Minutes P.I. Civil Engin.* **199** (1919): 377–397. **White.**

Pamban Viaduct, South Indian Railway. By C. R. White. *Illustrations.*

The opening of the railway affording communication between India and Ceylon was referred to in vol. **43**, p. 693.

Japan—Volcanoes. *C.R.A. Sc.* **161** (1915): 30–32. **Deprat.**

Mode de formation de deux centres volcaniques japonais, l'Aso-San et l'Asama-Yama, comparés à des centres volcaniques d'âges géologiques anciens. By J. Deprat. *Illustration.*

Korea—Forests. *T. Korea Branch R. Asiatic S.* **6** (1915): 35–42. **Koons.**

Afforestation in Korea. By E. W. Koons.

Malay Archipelago—Celebes. **Adriani.**

Ts. K. Nederl. Aardr. Gen., 2 Ser., **32** (1915): 457–475.

Maatschappelijke, speciaal economische verandering der bevolking van Midden-Celebes, sedert de invoering van het Nederlandsch gezag aldaar. Door N. Adriani.

Malay Archipelago—Sumatra—Geology. **Hirschi.**

Ts. K. Nederl. Aardr. Gen., 2 Ser., **32** (1915): 476–508.

Geologische Reiseskizze durch das äquatoriale Sumatra. Door H. Hirschi. *Maps and Illustrations.*

Malay Archipelago—Zulla Islands. **Brouwer.**

Ts. K. Nederl. Aardr. Gen., 2 Ser., **32** (1915): 509–512.

Over de geologie der Soela-eilanden. Door H. A. Brouwer.

This group lies between Celebes and the Moluccas.

AFRICA.

Africa—Language. **O'Leary.**

Characteristics of the Hamitic languages. By Dr. De Lacy O'Leary. Bristol: J. Wright & Sons, [1915]. Size 7½ × 5, pp. 46. *Price* 3*s.* 6*d. net. Presented.*

Africa—Travel. **Blackburne-Maze.**

From Oriental to Occidental Africa. By C. I. Blackburne-Maze. Maidstone: Privately printed, 1914. Size 9 × 6, pp. 188. *Map and Illustrations.*

A diary of a journey from Mombasa to Banana on the west coast.

Algeria—Pastures. *B. Trim. S.G. Archéologie Oran* **36** (1915): 208–212. **Ben Danou.**

Contribution à l'étude de l'industrie pastorale en Algérie. Rôle mécanique des vents dans la répartition des fourrages steppiens. Comment densifier les herbages. By C. Ben Danou.

The writer holds that the sparseness of the forage plants is due to the action of the winds in sweeping away the humus and seeds of plants; and that matters would be improved by the construction of obstacles such as low dykes.

East Africa—Travel. **Blackburne-Maze.**

Journals of my African travels. By C. I. Blackburne-Maze. Maidstone: Privately printed, 1913. Size 9 × 6, pp. 241. *Illustrations. Presented.*

Diary of a journey from Cairo to Mombasa, with sixty-seven excellent photographs.

German East Africa—Rainfall. **Schlikker.**

M. Deutschen Schutzgebieten **28** (1915): 1–41.

Beitrag zu den Regenverhältnissen im Küstennahen Gebiete von Deutsch-Ostafrika. Von Bernhard Schlikker. *Illustrations.*

Morocco—Atlas. *C.R.A. Sc.* **161** (1915): 103–105. **Gentil.**

Les analogies du Haut Atlas marocain et de l'Atlas saharien. By Louis Gentil.

Morocco—Political. *L'Afrique Française* **25** (1915): 160–187. ———

La situation politique et militaire au Maroc. *Maps.*

South Africa—Magnetism. *T.R.S. South Africa* **4** (1915): 181–203. **Beattie.**

The secular variation of the magnetic elements in South Africa during the period 1900–1913. By J. C. Beattie. *Charts and Diagrams.*

South Africa—Political. *G.Z.* **21** (1915): 198–226. **Uhlig.**

Der südafrikanische Bundesstaat und Deutsch-Südwestafrika. Von Carl Uhlig.

Tripoli. **Nappi.**

Agricoltura, Industrie e Commercio della Tripolitania. By Cav. Romeo Nappi. (Ministero delle Colonie, Rapporti e Monografie coloniali, N. 1 (1914), p. 124.)

Tripoli—Cyrenaica. **Mei.**

Gli abitanti della Cirenaica. Studio etnico-antropologico del Dott. Aldo Mei. (Ministero delle Colonie, Rapporti e Monografie coloniali, N. 10 (1914), pp. 76.) *Map and Illustrations.*

Tripoli—Nomadism. **Stroppa.**

Nomadismo e nomadi della Tripolitania (propriamente detta). Relazione del capitano di fanteria Francesco Stroppa. (Ministero delle Colonie, Monografie e Rapporti Col., N. 1 (1915), pp. 123.) *Illustrations and Sketch-maps.*

NORTH AMERICA.

Alaska—Glaciers. *B. American G.S.* **47** (1915): 172–174. **Martin.**

Glacial Scenery in Alaska. By Laurence Martin. *Illustrations.*

Canada—British Columbia—Selkirks. **Harnden.**

Canadian Alpine J. **6** (1914 and 1915): 103–111.

Exploration in the Southern Selkirks (1913). By E. H. Harnden. *Maps and Illustrations.*

Canada—Coal. *Canada, Geol. Surv., Mem.* **59** (1915): pp. viii., 174 and vi. **Dowling.**

Coalfields and coal resources of Canada. By D. B. Dowling. *Maps.*

Reprinted, with additions, from 'The Coal Resources of the World,' prepared in connection with the Canadian meeting of the International Geological Congress (cf. *Journal*, vol. **44**, p. 313).

Canada—Coal. *Canada, Geol. Surv., Mem.* **53** (1914): pp. iii., 142 and v. **Dowling.**

Coalfields of Manitoba, Saskatchewan, Alberta, and Eastern British Columbia (Revised edition). By D. B. Bowling. *Map and Illustrations.*

Canada—Hudson Bay—Exploration. *B.S.G. Quebec* **9** (1915): 140–149. **Le Vasseur.**

La Baie d'Hudson. By N. Le Vasseur.

See note in the September number, p. 241.

North America—Early exploration. **Finley.**

The French in the Heart of America. By John Finley. New York: C. Scribner's Sons, 1915. Size 8½ × 6, pp. x. and 432. *Presented.*

United States—New Jersey. **Johnson and Smith.**

Popular Sc. Monthly **86** (1915): 557–567.

Wave Work on the New Jersey Coast. By Douglas W. Johnson and Warren S. Smith. *Illustrations.*

United States—Oregon. **Henshaw, Lewis, and McCaustland.**

U.S. Geol. Surv., Water Supply Paper **344** (1914): pp. 200.

Deschutes River, Oregon, and its utilization. By F. F. Henshaw, John H. Lewis, and E. J. McCaustland. *Maps and Illustrations.*

United States—Sierra Nevada. *Sierra Club B.* **9** (1915): 225–239. **Muir.**

Studies in the Sierra: 1. Mountain Sculpture. By John Muir. *Illustrations.*

United States—Texas. **Deussen.**

U.S. Geol. Surv., Water Supply Paper **335** (1914): pp. 365.

Geology and underground waters of the south-eastern part of the Texas coastal plain. By Alexander Deussen. *Maps, Sketch-maps, and Illustrations.*

CENTRAL AND SOUTH AMERICA.

Bolivia—Archæology. *Ymer*, 1915 (1915): 169–185. **Nordenskiöld.**

Incallacta, eine befestigte und von Inka Tupac Yupanqui angelegte Stadt. Von Erland Nordenskiöld. *Sketch-map, Plan, and Illustrations.*

Brazil—Amazon. **Walkey.**

The Amazon as a river, a problem, and a call, together with some practical suggestions. By Rev. O. R. Walkey. [Worthing, 1915.] Size $6\frac{1}{2} \times 4$, pp. 4. *Maps.*

Brazil—Fernando Noronha. **Murphy.**

Ten hours at Fernando Noronha. By Robert Cushman Murphy. (From *The Auk*, vol. **32**, 1915.) Size $9\frac{1}{2} \times 6\frac{1}{2}$, pp. 41–50. *Illustration.*

Brazil—Minerals. **Calvert.**

Mineral resources of Minas Geraes (Brazil). By Albert F. Calvert. London: E. & F. N. Spon, 1915. Size $9 \times 5\frac{1}{2}$, pp. xvi. and 100. *Sketch-maps and Illustrations. Price 6s. net. Presented.*

Brazil—Negroes. *Rev. I.G. e Historica Bahia* **10** (1915): 39–72. **Amaral.**

As tribus negras importadas. By Braz do Amaral.

AUSTRALASIA AND PACIFIC ISLANDS.

Atlantic Ocean—Trinidad islet. **Murphy.**

The bird life of Trinidad islet. By Robert Cushman Murphy. (From the *Auk*, vol. **32**, 1915, pp. 332–348.) N.P., 1915. Size $9\frac{1}{2} \times 6\frac{1}{2}$. *Map and Illustrations.*

Includes a list of literature on the island.

Australia and New Zealand. *J.R.I. British Architects* **22** (1915): 437–448. **Davidge.**

Town planning in Australia and New Zealand. By W. R. Davidge. *Illustrations.*

Will be noticed in the Monthly Record.

Pacific—Russian expansion. **Golder.**

Russian expansion on the Pacific, 1641–1850. By F. A. Golder. Cleveland: A. H. Clark, 1914. Size $10 \times 6\frac{1}{2}$, pp. 368. *Facsimiles. Price 21s.*

POLAR REGIONS.

Arctic—Vega Expedition. *Ymer* 1915 (1915): 3–15. **Montelius.**

Vegas ankomst till Stockholm den 24 April 1880. Af Oscar Montelius. *Illustration.*

The opening article of a number largely devoted to the voyage of the *Vega*, the thirty-fifth anniversary of which has been celebrated this year. A portrait of Captain Palander is given.

Arctic—Vega Expedition. *Ymer* 1915 (1915): 16–27. **Nordenskjöld.**

I Vegas fotspår. Af Otto Nordenskjöld.

Greenland—Expedition. *Ymer* 1915 (1915): 133–163. **Rasmussen.**

Den første Thule-Ekspedition frem og tilbage over Inlandsisen. Af Knud Rasmussen. *Maps and Illustrations.*

Spitsbergen. *La G.* **30** (1915): 277–279. **Staxrud and Hoel.**

Résultats de l'expédition norvégienne au Spitsberg en 1914. By Arve Staxrud and Adolf Hoel. *Map.*

Continuation of the same traveller's previous geological and other work in Western Spitsbergen (cf. *Journal*, vol. **39**, p. 162; **41**, p. 592; **42**, p. 403).

MATHEMATICAL GEOGRAPHY.

Geodesy. *Atti R.A. Lincei*, Ser. V., *Rendiconti* **24** (1915): 1206–1212. **Bianchi.**

Sui valori del termine z nel problema della variazione delle latitudini. By E. Bianchi.

Map-reading. **Norcock and Wilson.**

Map Reading. A self-instructional manual. By Captain L. Norcock and Captain F. S. Wilson. London: Sifton, Praed & Co., 1915. Size 8½ × 7, pp. 110. *Sketch-maps and Diagrams. Price 4s. 6d. net. Presented.*

See review, *supra*.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Climatology. *Ymer* 1915 (1915): 83–97. **Norlind.**

Till frågan om det historiska klimatet, särskildet i Nord- och Mellaneuropa. Af Arnold Norlind.

Earth-movements. *American J. Sc.* **40** (1915): 1–22. **Barrell.**

Factors in movements of the strand line and their results in the pleistocene and post-pleistocene. By Joseph Barrell. *Illustrations.*

Geology—Soils. **Ferrar.**

Soil-Productivity and Agro-Geological Surveys. By H. T. Ferrar. (From the *Journal* of the Canterbury Agricultural and Pastoral Association, vol. **3**, 3rd series, May, 1915.) Christchurch, N.Z., 1915. Size 8½ × 5½, pp. 28–35.

Geomorphology. *Ymer* 1915 (1915): 67–82. **Ahlmann.**

Geomorfologien som modern vetenskap. Af Hans W:son Ahlmann.

Geomorphology. *Scottish G. Mag.* **31** (1915): 393–406. **Falconer.**

Land Forms and Landscapes. By J. D. Falconer. *Illustrations. Also separate copy.*

Terrestrial Magnetism. **Bauer and Fleming.**

Researches of the Department of Terrestrial Magnetism. Vol. 2. Land magnetic observations 1911–13, and reports on special researches. By L. A. Bauer and J. A. Fleming. (Carnegie Institution Publication, No. 175.) Washington, 1915. Size 12 × 9, pp. vi. and 278. *Plans and Illustrations. Presented.*

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Colonization. **Hauser.**

La guerre Européenne et le Problème Colonial. Par Henri Hauser. Paris: Librairie Chapelot, 1915. Size 7 × 5½, pp. 112. *Presented.*

Historical—Early map. *Riv. G. Italiana* **21** (1914): 481–496. **Grande.**

Attorno ad una nuova carta nautica di Giovanni Riczo Oliva. By Stefano Grande.

Describes for the first time a finely illuminated chart by this cartographer, dated 1588 (see *Journal*, vol. **45**, p. 342).

Historical—Strait of Anian. *B. American G.S.* **47** (1915): 161–172. **Sykes.**

The Mythical Straits of Anian. By Godfrey Sykes. *Maps and Illustrations.*

See note in the June number, 1915, p. 540.

BIOGRAPHY.

Dalla Vedova. **Magistris.**

Biografie di Geografi e di Esploratori contemporanei. I. Giuseppe dalla Vedova. By L. F. de Magistris. Novara: Instituto Geografico de Agostini. N.D. Size 7½ × 4½, pp. 18. *Portrait.*

For some years President of the Italian Geographical Society.

GENERAL.

Educational. **Wallis.**

W. & A. K. Johnston's geographical exercise-book for Indian students, with questions by B. C. Wallis. London: Macmillan & Co., [1915]. Size 10 × 7½, pp. 52. *Sketch-maps. Presented.*

Exploration. *Smithsonian Miscellaneous Collections* **65** (1915): No. 6, pp. 95. ——

Explorations and Field-work of the Smithsonian Institution in 1914. *Illustrations.*

Geography in Germany. *La G.* **30** (1915): 269-276. **Rabot.**

La géographie en Allemagne pendant la guerre. By Charles Rabot.

A review of recent German serial literature in the domain of geography, whether concerned with the war or not.

Travel—Hints. **Stewart.**

Active service pocket-book. By the late Captain Bertrand Stewart. 6th edit. London: Wyman & Sons, [1914]. Size 5½ × 4½, pp. xxx. and 924. *Illustrations and Diagrams. Price 5s.*

Year-book. **[Dardeno and De Magistris.]**

Calendario atlante de Agostini, 1915. Anno XII., Serie II., vol. 2. Novara: Istituto Geografico de Agostini, [1915]. Size 6½ × 3, pp. xl. + 131. *Maps and Text.*

A useful collection of data, both general and relating to special countries, with maps.

NEW MAPS.

By E. A. REEVES, Map-Curator, R.G.S.

EUROPE.

Austro-Hungary. **Colocci.**

Adriano Colocci: Carta-Base pel Raggruppamento Politico delle Nazionalità nell' Austria-Ungheria e Stati Limitrofi. 2ª Edizione. Scale 1: 4,000,000 or 1 inch to 63·13 stat. miles. Size 12 by 14 inches. Novara: Istituto Geografico De Agostini, 1915. *Price* 0.40 *Lira. Presented by the Publishers.*

The second edition of a diagrammatic map of Austria-Hungary and adjacent territories, showing the boundaries of the rearrangement according to nationalities suggested by the author. The map is preceded by fifteen pages of explanatory and descriptive letterpress.

Austro-Italian Frontier. **Agostini.**

Carta del Teatro della Guerra Nostra. Carta a tinte ipsografiche alla scala di 1 : 500,000 (1 inch to 7·89 stat. miles). Size 24 by 37 inches. Novara: Istituto Geografico De Agostini, 1915. *Price* 1.50 *Lire. Presented by the Publishers.*

A map of the theatre of war on the Italian frontier, showing the present and proposed international boundary. Relief is in brown shading and superimposed colours, the tints of which might certainly have been improved.

Balkan Peninsula. **Evans.**

Diagrammatic Map of Slav Territories east of the Adriatic. By Arthur Evans (issued for the Balkan Committee). Scale 1 : 1,500,000 or 1 inch to 23·6 stat. miles. Size 17 by 19 inches. London: Sifton, Praed & Co., 1915. *Presented by Sir Arthur Evans.*

The map includes the eastern coast-lines of the Adriatic and the north-west part of the Balkan Peninsula from the Italian frontier to Scutari, and extending to the east about 70 miles beyond Belgrade. It shows by bold coloured lines the boundaries of areas occupied by Serbo-Croats, Slovenes (and Slovaks in Hungary), Germans, Italians, Roumans, and Albanians. On it are also laid down very clearly the principal existing railways, as well as those projected, special attention being given to the future overland route from Italy, France, and England to Constantinople and Salonika. It is more of a diagram than a map, but the information it contains will be useful at the present time. No one is better able to produce such a map than Sir Arthur Evans.

Balkan Peninsula. **Service Géographique de l'Armée, Paris.**

Balkans 1,000,000° (1 inch to 15·78 stat. miles). Sheets: Bucharest; Constantinople. Size 15 by 22 inches. Paris: Service Géographique de l'Armée. *Price* 1.25 *fr. each sheet.*

The sheets of this map previously published were noticed in the *Geographical Journal* for June last. They are all re-issues, with the new boundaries of the Balkan States boldly shown in red. With these sheets the map is complete.

Europe. **Agostini.**

Europa Sud-Orientale. Carta Politica. Scale 1:3,000,000 or 1 inch to 47·3 stat. miles. Size 21 by 29 inches. Novara: Istituto Geografica De Agostini, 1915. *Price* 1.00 *Lira. Presented by the Publishers.*

Europe. **Agostini.**

Supplementi al Teato della Guerra Europea. I. Scacchiere Franco-Belga-Tedesco con indice-dizionario di 2000 nomi alla scala di 1:1,000,000 (1 inch to 15·78 stat. miles). Size 20 by 20 inches. II. Scacchiere Russo-Austro-Tedesco con indice-dizionario di 4000 nomi alla scala di 1:1,500,000 (1 inch to 23·67 stat. miles). Size 22 by 25 inches. Novara: Istituto Geografico De Agostini, 1915. *Price* 1.50 *Lira. Presented by the Publishers.*

Two general maps, one of the western and the other of the eastern theatre of war. At the side of each is a useful alphabetical index to place-names.

Europe. **Agostini.**

Teato della Guerra Europea. Scale 1:4,000,000 or 1 inch to 63·13 stat. miles. Size 27 by 37 inches. Novara: Istituto Geografico De Agostini, 1915. *Price* 1.00 *Lira. Presented by the Publishers.*

A general map of Europe, showing political divisions in various colours, and railways in red. A table is given, as an inset, stating the area and population of each country, together with military and naval statistics.

Germany. **Service Géographique de l'Armée, Paris.**

Généralisation de la Carte de l'Allemagne au 300,000° (1 inch to 4·7 stat. miles). Sheets: Chemnitz; Neustrelitz; Rostock; Stralsund. Size 16 by 18 inches. Paris: Service Géographique de l'Armée, [1915]. *Presented by the Director of Military Operations.*

Italy. **Agostini.**

Carta Ferroviaria Fisico-Politica del Regno d'Italia. Scale 1:1,500,000 or 1 inch to 23·67 stat. miles). Size 34 by 25 inches. Novara: Istituto Geografico De Agostini, [1915]. *Price* 1 *Lira.*

A small-scale railway and road map of Italy.

Italy. **Agostini.**

I due confini d'Italia. Carta fisico-politica alla scala di 1:1,250,000 (1 inch to 19.7 stat. miles). Seconda edizione. Size 13 by 22 inches. Novara: Istituto Geografico De Agostini, [1915]. *Price* 0.50 *Lira. Presented by the Publishers.*

Shows the present northern frontier together with new line claimed by Italy.

Mediterranean. **Agostini.**

La Guerra nell' Adriatico. Carta del mare Adriatico, Adiacenze e Porti Principali con 18 piani portuali. Scale 1:1,500,000 or 1 inch to 23·67 stat. miles. Size 34 by 20 inches. Novara: Istituto Geografico De Agostini, 1915. *Price* 1 *Lira. Presented by the Publishers.*

A chart of the Adriatic Sea and the coast of southern Italy, showing lighthouses, currents, telegraph cables, and wireless stations. It also contains 18 inset plans of the principal ports, on enlarged scales. On the land important places and railways are given.

Turkey. **E. Stanford.**

The Dardanelles and the Troad. Scale 1:190,080 or 1 inch to 3 stat. miles. Size 19 by 12 inches. The Bosphorus and Constantinople. Scale 1:95,040 or 1 inch to 1·5 stat. miles. Size 19 by 12 inches. London: E. Stanford, 1915. *Price* 3*s.*

AFRICA.

East Africa Protectorate. **Geographical Section, General Staff.**

Africa. Scale 1:1,000,000. Sheets: North A–37 (and part of A–38), Marsabit, size 18 by 32 inches; South A–37 (A–38 and part of B–37), Mombasa-Nairobi, size 23 by 32 inches. Drawn and printed at the War Office, 1915. London Agents:

E. Stanford, Ltd.; Sifton, Praed & Co.; T. Fisher Unwin. *Price 2s. net each sheet. Presented by the Director of Military Operations.*

These two sheets together form an excellent general map of the greater part of the Protectorate, extending from the Abyssinian boundary on the north to the boundary of German East Africa on the south, and from the 36th meridian to the coast. A considerable amount of good survey work has been done in recent years by the Survey Department at Nairobi, and this has all been carefully dealt with in the compilation, as have also the route traverses of the various travellers who have explored the little-known parts of the north, and between the Tana and Juba rivers. Where regular surveying has been carried out, based upon triangulation, such as in the neighbourhood of Mombasa, along the boundaries and the country around Nairobi and Fort Hall, the data for such a map as this is all that could be desired, but the exploratory surveys vary much as to their accuracy and the degree of dependence that should be placed upon them. Some of the work, like that of Mr. Archer, who connected the Anglo-Abyssinian boundary with the surveys of the south by carrying a triangulation across the country, and that of Mr. Dracopoli, who adjusted his route traverse to the east of the Lorian swamp by carefully determined astronomical positions, is doubtless good and reliable; other mapping has been done in the roughest manner. As will be seen at a glance, many parts are still unsurveyed, and some quite unexplored; but these are rapidly diminishing in size, owing to the enterprise of the Survey Department, and of administrative and military officers, and private individuals.

The sheets have been produced as far as possible in conformity with the 1:1,000,000 International Map scheme, and are numbered accordingly; but in order to include the desired area, it has been necessary to add portions of the adjacent sheets. No attempt has yet been made to show relief by colour tinting. Contours in brown, at 100-metre intervals, are given, together with numerous spot heights; where the data is unreliable there are approximate contours in dotted lines.

The map will be very useful, specially at the present time.

Egypt. **Egyptian Survey Dept.**

Topographical Map of Egypt. Scale 1:10,000 or 6·3 inches to 1 stat. mile. Sheets: N.E. 13-26, 14-24, 14-27, 15-25, 15-27, 21-12, 21-16, 21-18, 21-20, 22-18, 22-20, 23-14, 23-15, Mudiriyet Esh-Sharqiya. N.W. 23-20, 24-20, Mudiriyet El-Beheira. Giza: Survey Department, 1914. *Presented by the Egyptian Survey Department.*

AMERICA.

Canada. **Dept. of the Interior, Ottawa.**

Sectional map of Canada. Scale 1:190,080 or 1 inch to 3 stat. miles. Sheets: 116, Rainy Hills, Alberta, 7th edit., 1914; 117, Red Deer Forks, Saskatchewan, 7th edit., 1915; 167, Bad Hills, Saskatchewan, 6th edit., 1915; 168, The Elbow, Saskatchewan, 7th edit., 1915; 222, Waterhen, Manitoba, 2nd edit., 1914. Size 18 by 32 inches. Ottawa: Department of the Interior, 1914–15. *Presented by the Department of the Interior, Ottawa.*

Canada. **Dept. of the Interior, Ottawa.**

Sketch-maps and Profiles of Base Lines and Meridians. Horizontal scale 1:792,000 or 1 inch to 12·5 stat. miles; vertical scale 1:24,000 or 1 inch to 2000 feet. Size 23 by 32 inches.

Index to Townships in Manitoba, Saskatchewan, Alberta, and British Columbia to illustrate Progress of Dominion Land Surveys. Scale 1:2,217,600 or 1 inch to 35 stat. miles. Size 22 by 33 inches. From *Annual Report of the Topographical Surveys Branch Department of the Interior*, 1913–14. Ottawa: Department of the Interior, 1914.

These two sheets accompany the Annual Report of the Topographical Surveys Branch of the Department of the Interior for 1913–1914. The first is an outline index map showing by various colours subdivision surveys made prior to March 31, 1913; Subdivision surveys made from April 1, 1913, to March 31, 1914; Resurveys made from April 1, 1913, to March 31, 1914; Lines of Spirit Levels run prior to March 31, 1914, and Base and Meridian Lines run prior to March 31, 1914. Surveys in the Railway Belt in British Columbia are not shown owing to their scattered nature.

The second sheet contains ten maps and numerous vertical sections of the various base lines and meridians surveyed during 1913. Some of these would have been more serviceable if they could have been produced on rather larger scale, with the lettering more easily legible.

Canada—British Columbia. **Dept. of Lands, Ottawa, B.C.**

Pre-emptor's Map. Scale 1:190,080 or 1 inch to 3 stat. miles. Nos. 3 A, Fort George, revised to May 10, 1915; 3 B, Nechako, revised to April 8, 1915; 3 D,

Bulkley, revised to May 15, 1915; 3 G, Quesnel, revised to June 1, 1915; 3 K, Lillooet, revised to April 16, 1915; 3 L, Graham Island, revised to May 1, 1915. Victoria: Department of Lands, 1915. *Presented by the Surveyor-General of British Columbia.*

United States. **Pound.**

A New Mapp of New England from Cape Codd to Cape Sables, describing all the Sands, Shoals, Rocks, and Difficulties, together with a Sand Draft of the Mattathussetts Bay, exactly surveyed by the author Tho. Pound. Sold by Phillip Lea at the Atlas in Cheapside by Will^m Court, at the Mariner and Anchor on Tower Hill, and by George Flower near Ratliffe Cross [1691]. Facsimile, 1912, by Frederick Lewis Gay. *Presented by Frederick Lewis Gay, Esq.*

The original print from which this facsimile has been made is preserved in the Library of Congress, Washington, and, so far as is known, it is the only one in existence. Mr. F. L. Gay, of Brooklyn, Mass., has recently had it reproduced by photography, and has been good enough to present a copy of this facsimile to the Society. The map, or rather chart, for it is more like a marine chart in appearance, is in two sections, one consisting of the coastline from Cape Cod to the Bay of Fundy and Nova Scotia, and the other consisting of an enlarged plan of Massachusetts Bay, with soundings and anchorages. The former is on the scale of about 13 miles and the latter ¾ mile to an inch. Beyond the fact that it was advertised for sale in the *London Gazette* of 1691, little seems to be known of this interesting map.

WORLD.

World. **Agostini.**

Dott. Prof. G. De Agostini: Atlante Geografico Metodico. Terza edizione riveduta ed ampliata. Size 10 by 12 inches. Novara: Istituto Geografico De Agostini, [1915]. *Price* 8.50 *lira. Presented by the Publishers.*

The third edition of an atlas prepared specially for the use of Italian schools. It consists of seventy-five sheets of maps, plans, and diagrams, illustrative of the various branches of geography. Many of the maps are in pairs, one showing the relief on the colour layer system and the other the political divisions.

World. **Agostini.**

Atlante Geografico Muto fisico politico a colori ed Albo di Esercitazioni Cartografiche in due fascicoli. Terza edizione. Size 10 by 11 inches. Novara: Istituto Geografico De Agostini, [1915]. *Prices, Part* 1, 1.50 *lire; Part* 2, 1 *lira. Presented by the Publishers.*

The third editions of two school atlases. At each opening the page on the left gives a map showing physical features and general relief, without names, and on the right-hand side a blank projection upon which it is intended that the scholar should produce a copy of the map on the opposite side.

CHARTS.

Burma. **Hunton and Ashton.**

Entrance to Rangoon River: Elephant Point to Fairway Buoy. Corrected to February, 1915. Surveyed by A. S. Hunton, F.R.G.S., River Surveyer under the direction of H. G. G. Ashton, F.R.G.S., Deputy Conservator of the Port. Scale 1: 36,305 or 2 inches to 1 nautical mile. Size 31 by 26 inches. Rangoon: Commissioners for the Port of Rangoon, 1915. *Presented by the Deputy Conservator of the Port of Rangoon.*

PHOTOGRAPHS.

Alaska and Canada. **Blount.**

One hundred and fourteen photographs of Alaska and Canada, taken by Mrs. Blount. 1914. *Presented by Mrs. Blount.*

Mrs. Blount, during her extensive travels, has visited some of the most out-of-the-way parts of North-West America, and made the best of her opportunity to take interesting photographs, as may be judged from the following list of those she has been good enough to present to this Society. Thirty-one of these are enlargements, which will later on be exhibited in our Photograph Room.

(1) Landing wharf and piers, Skagway, Alaska; (2) Skagway, Alaska; (3) Skagway: beginning of White Horse and Yukon railway; (4) White Horse Pass, near Skagway; (5) Top of White Horse Pass showing source of Yukon River and the White Horse and Yukon railway, Canada; (6) White Horse and Yukon railway in White Horse Pass; (7) Looking back towards White Horse, Yukon River, Canada; (8) White Horse, Yukon River, Canada: starting-place for river-boats; (9) Back view of Dawson City, Yukon River, Canada; (10) Klondike River and valley, Canada: thawing ground

with hydraulic pressure to get out gold; (11) Klondike River, Canada: dumps of stones left by dredges after abstracting gold; (12) Klondike River, Canada: sluice in gulley; dumps of stones left by dredger after gold is extracted; (13) Eagle City, Yukon River, Alaska, on Canadian frontier; (14) Nome, the capital of Alaska; (15) Nome, Eskimo village on sandspit; (16) Tanana, military station and important town on Yukon River, Alaska; (17) Holy City, Yukon River, a Roman Catholic settlement, Alaska: the boat in foreground is the hotel; (18) Old Hamilton, Indian village on Yukon River, Alaska; (19) Fort Yukon, Alaska: only settlement above arctic circle on Yukon River; (20) Near the mouth of the Yukon River, Alaska; (21) Eskimos in a kazhem, or bathing-place, St. Michael's, mouth of Yukon River, Alaska; (22) St. Michael's, island and wireless station; (23) U.S. mail arriving at St. Michael's; (24) Herd of reindeer changing pasture at St. Michael's: the wireless station on the left; (25) The schoolmistress at St. Michael's paying calls in winter; (26) An Eskimo at St. Michael's; (27) Seward, Alaska: Malamutes (half-wolf, half-dog) and huskies taking the mail from Seward to Fairbanks, 600 miles; (28) Kitwangar, an Indian village, on the Skeena River; (29) Alert Bay, Cormorant Island, Queen Charlotte Sound, British Columbia; (30) Bow River, near Calgary, Alberta; (31) Dawn in the Unimak Pass, Aleutian Islands; (32) Fine crop of oats near Calgary; (33) Prairie farm near Gleichen, good crop of alfalfa in foreground; (34) Outbuildings, same farm; (35) C.P.R. irrigation for prairie farms: the canal from which the 36 laterals flow: each lateral goes to highest point on the farm, and the farmer dams up the water and makes it go to any part of his land that is dry; (37) The family digging potatoes; (38) Harrowing; (39 and 40) Thrashing; (41) Indian reservation south of Calgary: Blackfoot Indian by his teepee, with his blanket and vulture's wing: his name was "Son of the White Cow"; (42) Blackfoot Indian's teepee; (43) Ornamented teepee: (44) "Skunk Tallow" in his war attire, Blackfoot Indians; (45) Grave of "Skunk Tallow's" father; (46) Indian graves, bodies put in half-open boxes with all their belongings and lots of kitchen things; (47) Another Blackfoot Indian graveyard; (48) Indian church and schools near Gleichen, Alberta; (49) Indian huts; (50) Cluny, a prairie townlet; (51) Indians driving home after shopping in Cluny, any horse or pony joins the party from the prairie, sometimes a large number surround the cart; (52) Okanagau landing stage; (53) Fruit farm; (54) Capilano Cañon near Vancouver; (55) Vancouver City; (56) Vancouver City Law Courts; (57) Street in Alert Bay, B.C; (58) Wireless Station at Prince Rupert, Alaska; (59) Wrangell: Skakes' totem, Black Raven tribe; (60) Wrangell: Skakes' totems, Bear tribe; (61) Wrangell: Indian's totem, Black Whale tribe; (62) Chief's shack and totem at Ketchi Kan; (63) Indian's grave near Stikine River; (64) Indian's totem, Bear tribe; (65) Baby moose at Skagway; (66) Back view of Dawson City; (67) Dawson City Law Courts; (68) Dawson City, Front Street; (69) Klondike dredger in river getting up gold; (70) Klondike: old shack left by gold-seekers of, 98; (71 and 72) Klondike: hydraulic pressure to thaw the ground to get out the gold; (73) Klondike river a long way up from Dawson; (74) Klondike river: the method of crossing; (75) Huskies and malamute dogs awaiting steamer: one of the sights of the Yukon River; (76) Drying torn cod to feed dogs in winter with: one of the industries on Yukon river; (77) Lighthouse on Yukon River near Circle; (78) Circle, on Yukon River; (79) Indian village on Yukon; (80) Cargo of dog-salmon dried for dog food; (81) Skagway Street, White Horse Pass: railway in centre of street; (82) Lake Bennet: top of White Horse Pass; (83) Caribou above the pass; (84) White Horse: Hospital and Free Library; (85) River steamer going to Iditarod; (86) Iditarod: one million pounds gold-dust brought to the small shop by dog-sleighs; (87) Nenana Mission and garden; (88) Holy Cross R.C. Mission, boys; (89) Holy Cross R.C. Mission, girls; (90) Nulato Cemetery; (91) St. Michael's mouth of Yukon, blockhouse; (92) St. Michael's jail; (93) Russian church, St. Michael's, and sidewalk; (94) St. Michael's Street, only tundra grows; (95) St. Michael's Street, hotel at end on left; (96) St. Michael's: Eskimo drying dog-salmon for dog food; (97) St. Michael's: Eskimo chief and brother in Kagghem; (98) St. Michael's: outside of Kazhem, a bathing-place; (99) St. Michael's: the town bear drinks beer; (100) Off Golovin on Norton Sound; kyaks: (101) Nome seafront; (102) Nome Street 1 mile long: half the houses are shut or injured; (103) Eskimo village on sandspit at Nome; (104) Nome: dogs under a bidarha; (105) Eskimo village near Nome; (106) Road house near Fairbanks; (107-113) Types of Indians and Eskimo; (114) Panorama of Dawson City on Yukon River.

N.B.—It would greatly add to the value of the collection of Photographs which have been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.